JOURNAL OF GAS LIGHTING, WATER SUPPLY, &c.

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VOL. CXIII., No. 2489.——TUESDAY, JANUARY 24, 1911.

EDITORIAL NOTES—GAS, &c.

Paddington's Choice.

ANOTHER addition to the list of successes of the Gaslight and Coke Company, in connection with the public lighting contracts that have fallen due for determination the past few months, is the Borough of Paddington, although the Metropolitan Electric Supply Company made strenuous efforts to move the powers that be to have the contract divided between them and the Gaslight Company. But they did not succeed; the Borough Council being in a position to deal with the matter from an administrative point of view not curtailed by ownership of an electric undertaking. The Electric Supply Company cannot complain of unfair treatment. For months decision in the matter has been postponed at their request. They entered on their tendering with all the figures of the Gaslight Company spread before them. Their tender even then was unsuccessful. They entreated the Council for a special interview, at which to submit a fresh suggestion and some revised terms. They realized their desire for a hearing; but they failed to do anything to upset the *status quo*. The General Purposes Committee of the Council have found no reason to modify their original determination to have the illumination of the streets of the borough improved by the adoption of modern gas-lamps with inverted fittings; the capital expenditure involved in making the change being repaid to the Gaslight and Coke Company in ten equal annual instalments. There are two figures that are peculiarly interesting in connection with this success, and which figures are the tributes to a full confidence on the part of the Borough Council. The contract is for no less than ten years; and it was finally awarded by the Council to the Gaslight Company by 35 votes to 2. In connection with the public lighting contracts that have been going north of the Thames, the inverted gas-burner has had a signal succession of good fortune on its merits alone. It succeeded in Westminster, Hackney, Bethnal Green, Finsbury, Stoke Newington, Chelsea, and now in Paddington. In South London, too (as mentioned in the special reference to Paddington in our news columns), there have been notable successes. Some of these boroughs are partially lighted by electricity; some are not. Some, too, are supplied with electricity by the Borough Councils. Under such varied circumstances, the repeated successes of the inverted gas-burner require a lot of explaining away by the electricians. The only London contracts that have lately gone over to electricity are in boroughs where the electricity supply is municipally controlled, and where perhaps the Electricity Committee also fulfil the functions of the Public Lighting Committee, or have an influence on the Council that only admits of the question being considered in an altogether oblique fashion.

Special Treatment in Illumination.

ARTIFICIAL illumination is stepping out of the old ruts of haphazard application and use; and we are not at all sorry to see the change coming about. There is growing recognition among those in authority in places the supply of the means of lighting to which it is desired to retain or obtain by both gas and electricity purveyors, that illumination is an art, and that its provision should be on lines that are best adapted to every need and circumstance. The truth, for instance, is now worming its way into the knowledge of such authorities that uniform lighting is not the best thing for disuniform needs and environment. Every man who is technically or commercially concerned in lighting matters must face the changing view, and act accordingly. The art of illumination in all its various phases must be brought to bear upon the lighting business; and it must be seen that the means employed are the best adapted to the purpose. Schools, factories, and public libraries are among places the artificial lighting of which requires special treatment, room by room, to meet distinct requirements. Illustration is afforded in the papers read yesterday week before the Illuminating Engineering Society. Two of the contributions were by librarians—Mr. J. Duff Brown, of Islington, and Mr. L. Stanley Jast, of Croydon; the third was by Mr. John Darch, of the architectural profession. The rapid growth of public libraries and reading-rooms that marked the closing years of last, and the opening ones of the present, century, has been a feature of our modern civic life; but about most of them—including those under the control of the State—there has been the one striking characteristic of neglect in effecting as close an association as possible between lighting provision and requirement. So much so is this the case, that it is an open secret that when, only a few weeks ago, the new home of the Institution of Electrical Engineers was opened, the lighting arrangements in the library were so incompatible with needs that there had to be some revision. When such a thing happens in the very home of the electrical profession, it can be well understood why the lighting of so many public libraries and reading-rooms exposes itself to the criticism and the complaints of those who use them.

Public libraries and reading-rooms being under the control of municipal authorities, and municipal authorities so extensively governing electricity supply, a great number of such establishments are illuminated electrically. The two librarians who read papers at the meeting last week, have their libraries electrically illuminated; and the electricity supply of both Islington and Croydon is in the hands of the local authorities. Nevertheless, Mr. Dow criticized the lighting of the Islington libraries, and Mr. Jast the lighting of those at Croydon under his charge, in which there is a combination of unsuitability and makeshift, aided by a plentiful supply of flexible wiring—the whole being the product of electrical skill and in appreciation of need. The criticisms indicate that the electrical engineer as an illuminating expert has not honour in his own country. In fact, the librarian of Battersea had no hesitation in expressing an opinion that gives one an insight as to his feeling upon the question of the qualification of municipal electrical engineers for carrying out schemes of illumination for libraries. Perhaps it may be conceded to be an extenuating circumstance, that for such places, and for others that might be mentioned, the problems bearing on suitable illumination are many; and though general fundamental requirements are now before us, no method of treatment can be propounded that can have general application. Treatment of a haphazard character may result in perfectly grotesque lighting effects in relation to the purposes of a library and reading-room, and may largely diminish the practical value of the premises. In every case, all the conditions require detailed study. Hardly any two public libraries can be said to be alike; and the character and uses of the rooms themselves in any one library are altogether diverse. Papers, print, and drawings to be read or examined also differ in various ways; and there is the inconsistency of human vision. As Mr. William Whitaker tersely put it, during the discussion on the papers, there are libraries and libraries, readers and readers, and eyes and eyes; and while admittedly it is impossible to hope to do more than legislate for the majority of the users of libraries, it is the business of those who provide artificial light to ensure that, through the means provided, the maximum practicable utility for all is secured.

The object of dealing with this subject in the editorial columns is not so much with the intention of showing what is necessary in regard to library lighting, but to drive home the need of studying special means to suit special ends. In any place intended for individual reading, study, and reference, uniform lighting will not comply with the requirements of disuniform eyes and disuniform work. In the lighting of the various rooms of a public library, there seems to be very fair agreement now that a general scheme of illumination is necessary, with reinforcement by point-lighting upon tables

and over desks (in studied position), and along book cases. It may be taken that what is wanted is a minimum of illumination of from 4 to 5 foot-candles on tables and desks, and about 1½ foot-candles for book-shelves. These are general conditions for specification; and the best means of satisfying these conditions are the next consideration. The means are very important; and in connection with them, there are things to be avoided and to be secured. There is the question of avoiding glare and shadows, and at point-lighting of obtaining a good range of adjustability. Though many public libraries are electrically lighted, there appears to be—elaborate though some of the installations are—much that is open to condemnation. The librarian at Battersea says that ten years ago he gladly (the Borough Council control the electricity supply) discarded gas. But in the same breath he avows that they have ever since been experimenting to get the electrical installation right for various purposes; and he hopes—only a hope—that some day they will achieve their object. It seems to take a long time to obtain with electric lighting what is required in libraries and reading-rooms. The librarians complain of how they are squeezed in the matter of expenditure for lighting; they show their sense of economy by advocating a system of illumination that is expensive in installation and upkeep, that requires special treatment on account of glare, and that does not admit of any single point of lighting being turned up or down to any degree of illumination that the user desires.

The requirements are to be realized by gas; and, in the past ten years, the means of applying gas, and the efficiencies obtained in illumination, have shown a progressiveness that should, if demonstrated to him, soften even the electrically governed heart and intelligence of the Public Librarian for Battersea. Mr. John Darch, in his paper, pointed out that better than electric arc lamps for general illumination in libraries and reading-rooms are gas or Wenham regenerative ventilating lamps. The best lamp for a soft general diffusion of light in a large reading-room without "whip-"lashing" of the eyes, is undoubtedly the high-power inverted ventilating gas-lamp—such, for instance, as is used in their lecture room by the Society of Medical Officers of Health. And for point-lighting over tables and desks, there are the bijou inverted gas-lamps, fixed to adjustable (any angle or direction) stand fittings, and enclosed in a reflector-shade, so that the light can be thrown where needed without affecting the eyes of readers, while the burners themselves are readily adjustable by the readers to give any illumination desired. Convenience and economy are combined in a gas system designed to meet the special needs of such a case as library lighting; and this convenience and economy can be realized without the glare that is inseparable from the latest forms of electric lamps, and necessitates the use of costly globes. The chief officials at some of our public libraries, it is quite manifest, have lost touch with the progress effected in gas-lamps and fittings during the long period that they have, under the guidance of the interested officials in another municipal department, been experimenting, without (it is acknowledged) success, to produce a system of illumination that incorporates all the requirements of their special circumstances.

Correction of Pressure Misconceptions.

Would that there were more addresses of the character of the one that Mr. William Cranfield delivered to the Yorkshire Junior Gas Association last Saturday, under the modest title of "Some Aspects of Pressure"—a subject that crops up in different ways, and with different effects, right away from the retorts through the plant, distribution system, to the very point of combustion on the consumer's premises or in the street gas-lamp. Ask almost any gas man what he understands by gas pressure, and what are the actions producing certain pressure effects in different parts of his manufacturing plant and in the appliances in which the gas is used, and the inquirer will doubtless be in a position upon receiving the answer to sum up the knowledge in a comparatively few concise sentences. As a matter of fact, by the rank-and-file and the juniors of the gas profession, there is probably no single matter connected with their technical work that is so little understood, and so much misunderstood, as pressure. Conventional phrases abound in connection with it; and with many they take the place of an intelligent grasp of the reality that lies behind. One has only to read the address now before us, and cast the mind back over contributions on pressure that we have had over a long course of years before technical organizations to realize the truth of this. Mr. Cranfield has doubtless realized it in his protracted and intimate contact and intercourse—a contact and an intercourse perhaps without equal—as an instructor and lecturer, with professional gas students, whose knowledge reflects the current views, and the paucity of theoretical understanding, on the subject within the sphere in which they are daily gathering practical experience. It is only the exceptionally well-informed gas engineer who will lay aside this disquisition with the remark that there is no new interest in it for him. But, for the most part among readers, we think it will be hereafter consulted as a worthy work of reference. It is obvious that Mr. Cranfield has put into its preparation a large amount of labour. Even familiar facts he has dressed in fresh language, which he has taken pains should be, from a scientific standpoint, faultless in expression. As we say, we would that there were more addresses of this character, bringing together much scattered useful knowledge. Mr. Cranfield's address in 1909, upon "The Corrosion of Iron," was of similar type; and the addresses that have recently been delivered by experts at the Manchester University run on the same lines.

The address has compressed into it such a multitude of the aspects of pressure, that, in the brief compass of an editorial article, it would be unprofitable to essay to pass in review the described multifarious phases of pressure in the plant before the gasholder, in the holder itself, in the distribution system, and even beyond. But perhaps there will be an inclination to a little contention as to Mr. Cranfield's attempted dispersal of what he believes to be the misconception that exists in some professional minds as to the possibility of the stratification of gases in holders. We cannot altogether afford to neglect practical experience in favour of theoretical considerations. Twenty years ago, Mr. Frank Livesey, at the meeting of the Southern District Association of Gas Engineers and Managers, remarked:

> It is an opinion pretty generally accepted that when gases of different qualities are put into a gasholder a perfect mixture is soon obtained. This is not the writer's experience; for repeated experiments have shown that gases varying in quality to the extent of 2 candles may be left in a large holder two or three days, and at the end of that time can be delivered from the gasholder showing the same difference—a partial mixture having taken place at the dividing-line. It is, therefore, a difficult matter to raise the quality of gas in a gasholder by adding gas of a higher quality.

We come to a more modern instance, where for a time lean coal gas was being made, and a volume of richly carburetted water gas was periodically discharged into a large holder to effect compensation; and there was trouble with the variable illuminating power of the gas sent out from the holder, until the arrangements were altered, so that the gases were mixed in manner somewhat different from that of diffusion only within the holder. There is a case in mind of large carbonizing chambers where the charges of coal underwent twenty-four hours' carbonization. The first gas evolved was probably of upwards of 30-candle power, later of 11 or 12 candle power, and during the night hours it was of very poor quality. The conditions in that case were such that (so it was reported) resort had to be had to mechanical means of mixing in the holder to secure the distribution of gas of fairly uniform quality. The use of the word "strati-"fication" may be "unfortunate," to quote Mr. Cranfield; but under the circumstances related here—diffusion in the holders not taking place as desired and required, the application of the term, giving to it a limited meaning, does not appear to be a serious "terminological inexactitude."

But to many who read, and read with care, Mr. Cranfield's address—the many who have not considered this question of pressures beyond so ordering things that the pressure-charts on the works show fairly even lines, and that the initial pressures on the works give fairly uniform district and terminal pressures—they will find, as they proceed with the address, their interest in the subject deepened by its discussion in connection with the kinetic theory of gases. Throughout the main parts of the address, we have its application; and its application will give zest to the study of the question, will raise the importance of pressure in the eyes of the student, and will help to mature understanding of many of the actions that proceed in the carbonizing and other plant on the works and in the distribution system. The address on these matters is one to be studied; and we will not treat it to any (such as it would necessarily have to be here) meagre point by point comment. Certain it is that if the address is taken as a guide in investigation

and study, it will assist to remove many common fallacies. There is only one point referring to the consideration of the pressure effects of the oscillation in the hydraulic main. Has Mr. Cranfield ever had an opportunity of observing the results of the use of Mr. Meunier's invention, to which reference has been made in our columns on several occasions, both specially and in the course of the meetings of the Manchester Institution?

Underhanded Electrical Attacks.

POPULAR lectures, or lectures that are taken note of by local newspapers, are among the best possible forms of developing the interests of the gas industry. The affairs of the industry lend themselves very favourably indeed to popular treatment. One such lecture is that delivered last week by Mr. R. J. Rogers at Birmingham, before the Midland Association of Local Government Officers, as reported in abstract in other columns. He took for his subject the "Hygienic Aspects of Gas;" and he showed how utterly baseless are the assertions spread abroad in the electrical interests as to the polluting effects of incandescent gas-burners on the air of rooms, while how injurious to the sight are the unscreened modern forms of electric lamps. But his main advocacy was that a branch of the Smoke Abatement League should be formed in the city, on the same lines as in Glasgow, Sheffield, and other centres. This is a matter worthy of consideration in every large centre; as everything possible that can be done to supplant smoke-producing by gaseous fuel should be done. The question is one that stands in the very forefront of economic and sanitary considerations to-day; and the gas industry has a very intimate interest in the propagation of information concerning it. The Birmingham Gas Department is, like other gas undertakings, pushing the use of gaseous fuel as fast as possible, and not only by the domestic gas-fire, but by high-pressure gas distribution for industrial purposes. The subjects dealt with in the paper need no further remark; but in association with it there is another matter to be dealt with.

Mr. Rogers has brought down upon himself the wrath of a correspondent in the "Birmingham Daily Mail," who signs himself "Electrical Manufacturer." It does not say much for the case he has to present in opposition when he finds it necessary to take cover behind anonymity. Nevertheless, we will not ignore the criticisms of one who has not the courage to come out into the open the same as Mr. Rogers has done. His main objections are two. Exception is taken to the statements that electric light is injurious to the sight, and that it is inferior from the health point of view. With regard to the first question, the critic asserts that Mr. Rogers supported it by arguments that have long since been exploded. We should like to know where. The truth is that the members of the electrical profession are taking very seriously the growth of public opinion and complaint as to the effect that naked filaments of such intrinsic brilliancy as those of metallic filament lamps have upon the eyesight. "Electrical Manufacturer" has apparently not read the views that have been freely expressed by men who ought to know during the discussions on glare and the progress of electric lighting at recent meetings of the Illuminating Engineering Society, and by that reputable organ of the electricity industry the "Electrician." The anonymous writer places his postulations in antagonism with the views of Dr. Marchant, Professor of Electrical Engineering at the Liverpool University, Mr. A. P. Trotter, Electrical Adviser to the Board of Trade, and Mr. W. M. Mordey, late President of the Institution of Electrical Engineers, who, among others, have called attention to the danger to the eyes of the users of these lamps, and have earnestly advised that the lamps should only be used with prismatic or frosted globes or shades in order to prevent optical injury. We could here quote much electrical opinion on the subject, but will leave "Electrical Manufacturer" to show us that the eminent men referred to are ignorant and altogether at sea, and that their opinions are not worth acceptance before his own. With unfeigned delight, too, he calls attention to the mantles used with small (not large) units of high-pressure gas lighting. But it is too much to expect him to recognize what the "man in the street" knows very well, that high-pressure gas is not supplied for ordinary domestic lighting.

The rest of the case submitted by this correspondent who has reason to hide his identity is equally feeble. He goes on to allude to poisonous products of gas, and speaks, too, of the "poisonous" carbon dioxide from gas-burners. The use of the term "poisonous" is of a piece with the scurrility of electrical writers over a long period, and particularly so of anonymous ones. "Electrical Manufacturer" may be asked to give more definite information as to what are the poisonous products that he alleges are emitted by an incandescent gas-burner, and in what way the carbon dioxide is "posionous." Before doing so, we may direct his attention to two or three statements that will perhaps enable him to appreciate his error and, if he is not too mean-spirited (his anonymity rather raises doubts as to his compliance), acknowledge it. Pettenkofer has stated that pure carbon dioxide in the proportion of 100 parts per 10,000 parts of air is not injurious to human beings; while 10 parts of carbon dioxide if derived from the respiration or perspiration of human beings render the air unfit for a person to remain in it for any length of time. A cubic foot of gas on combustion yields approximately ½ cubic foot of carbon dioxide; a human being, when not sleeping, gives off about ¾ cubic foot of carbon dioxide every hour. Therefore, having regard to Pettenkofer's statement, ten bijou inverted burners could be used in a room, and would be less harmful to the occupants than one adult person. Weichardt, in the "Archiv für Hygiene" says gas-flames actually have a purifying effect (apart from the circulation of the air they set up), which electric lamps have not, on the atmosphere of rooms, by reason of their free combustion acting destructively on the organic products of respiration. The "Lancet" has also declared that "any carbon dioxide resulting from the combustion of "coal gas is quite insignificant compared with that exhaled "by the human individual. Of the two, the human exhalation is the more prejudicial to health." Professor Frank Clowes, Dr. Whitelegge, and Professor Carlton Lambert, among others, have confirmed this. We ask is evidence such as this to be ignored in favour of the declarations of an electrical manufacturer who throws stones from the obscurity afforded him by a *nom de plume*. We think not.

As to the relative quantities of carbon dioxide in the air of a room, scientific experiments have shown this to be less, in rooms provided with the simplest means of ventilation (not electric fans), with incandescent gas-burners than with electric lamps (see "JOURNAL" for Dec. 6 and 20 last, pp. 705, 863). This is due to the fact, as was expressed by Mr. G. Stanley Cooper, B.Sc., "that heated air rises, and "that carbon dioxide, though much heavier than air at the "same temperature, is much lighter than air when there is "a sufficient difference of temperature between them. In "other words, carbon dioxide produced at the gas-burner "is lighter than the surrounding air." A better circulation being created by an incandescent gas light than by an electric light, with simple ventilation the carbon dioxide from both gas and respiration would be more speedily removed, besides which the destructive effects of the gas-flame upon the organic products of respiration is a distinct gain from the sanitary point of view. We could pursue the subject much farther; but "Electrical Manufacturer" would perhaps prefer to deal with the matters so far advanced, before taking up additional ones.

Gas Publicity Committee.

It has come to the knowledge of the Gas Publicity Committee that some of the circulars addressed to the Chairmen of Boards and Committees of gas undertakings, to enlist the sympathy and the material support of themselves and their administrative colleagues, have unfortunately miscarried. It is therefore desired by the Committee (as will be seen by the letter from the Secretary, Mr. Walter T. Dunn, in our "Correspondence" columns) that, in cases where the circulars have gone astray, the reproduction in our columns last week (p. 149) may be utilized by the officers of the undertakings for the purpose of bringing the matter to the notice of their Chairmen and members of Boards and Committees generally. The work that the Committee are proposing to enter upon —and with vigour, given proper support—is one, as we were saying in our editorial columns last week, over which it is hoped to see a wave of enthusiasm pass through the entire industry. There is the Electricity Publicity Committee actively at work. The gas industry must not sit supinely by while the Committee prosecute their campaign to annex ground from the gas industry. Indifference to their proceedings in pushing the interests of the electricity industry, indifference to their calculated misrepresentations concerning gas, constitute precisely the attitude they would

like to see the gas industry take. Gas managements (every unit) must feel that the attitude that would best suit the competitors is not the one that is to henceforth exist. The financial question is the most important of all; and the Gas Publicity Committee's circular makes a suggestion on this point that we trust is receiving the favourable consideration of every gas undertaking large and small in the kingdom. It is understood that the Council of the Society of British Gas Industries have under consideration the matter of how the Society can assist in furthering this industrial movement. It will be remembered that, at their last meeting, Mr. James W. Helps threw out the suggestion that this was a matter of common interest and common defence, in which the Society could well co-operate.

A Word to Executive Officers.

The circular of the Gas Publicity Committee was addressed to the Chairmen of gas undertakings generally for the purposes of enlisting their personal sympathy and of bringing them into direct touch with the aims of the scheme. The chief officials of gas undertakings will duly appreciate this; and the Committee entertain full confidence—it cannot be otherwise—that every officer of a gas undertaking, whatever his position, is an adherent to the cause, and a collaborator of the Committee. It is the officers of gas undertakings who feel the brunt of the competitive pressure of the times; and they appreciate the importance of general educational and protective work. Without specially addressing them on the subject, the Committee have assurance that the heart of every officer is so completely in the cause, that each one will be a staunch advocate in and out of Board or Committee room, and that there will not be a single omission in seeing that the matter is brought forward in proper light and with the utmost enthusiasm. So we hope, and hope sincerely, that all have or will resolve.

Local Government Work.

In the course of some comparisons between company and municipal administration of public concerns, made by Mr. W. G. Towler in delivering a lecture at Newcastle, he remarked that it was difficult to gauge exactly what proportion of the nation's business was at the present time done by municipalities. By taking the figures out of the Local Taxation Returns, however, they could see that the capital invested in municipal undertakings at the end of March, 1908, was £342,000,000, or about one-fiftieth of the total national capital. After meeting capital charges, and making some provision for depreciation, there was not a great deal in the way of a surplus applicable to the relief of the rates. On the point of administration, Mr. Towler shortly summed up the differences which, to his mind, exist between company and municipally owned undertakings. A company, he pointed out, was usually a voluntary association of persons, mostly for a single object; while a municipality was a compulsory association of persons for a large number of complex objects—mainly governmental, and not trading. The directors of a company usually comprised one or more experts in a particular business; the remaining members of the Board probably exercising influence in securing custom. Shareholders received periodical reports as to the state of the concerns in which they had invested money; but how many citizens ever received or criticized the annual accounts of (say) a municipal electricity undertaking? Again, municipal committees were composed of men elected, not because they were experts or skilled in the technique or organization of tramways, or gas, water, or electricity supply, but mainly because they were prominent local politicians, or at best because they were men possessing some considerable leisure, and desired to help their city by taking part in the government of it. Mr. Towler, while saying this, at the same time took pains to make it clear that he did not for a moment wish to disparage the devotion and self-sacrifice of the men who were serving on municipal bodies. He pointed out that it was not a question of character or of willingness; the difficulty was that municipal work now demanded a technical knowledge as regarded the management of undertakings which was possessed only by those captains of industry who in the present stress of commercial competition had practically to devote the whole of their time to their own industries. Another aspect of the question of municipal trading to which he drew attention was the fact that every additional trading function undertaken by a municipality was an additional burden on a public body already overwhelmed with work. Mr. Towler, who is the Secretary of the London Municipal Society for the Promotion of Municipal Reform, is of opinion that a great deal more definite information is required regarding municipal undertakings, and that a Royal Commission on municipal trading would be a helpful step. In view of the small practical results that have accrued from the mass of evidence and statistics already collected on the subject (and recorded in Blue-Books), it is to be feared that many people will hesitate before joining in a request for the appointment of another Royal Commission.

Social Insurance.

The question of State-aided insurance having been lately brought somewhat into prominence, attention is being drawn to a section of the report on Foreign and Colonial Systems of Poor Relief recently published by the Royal Commission on the Poor Laws and Relief of Distress, which deals with schemes of social insurance—a plan that is stated to be one of the newer methods of giving public assistance to the wage-earning classes. Particulars are set forth of all existing schemes of insurance which are under official regulation, and under which the insured are assisted either by the employers or by public authorities, or both. From these, it seems that assisted insurance, to meet the risks of sickness and old age and invalidity, has been widely adopted. There are several small schemes affecting only persons occupied in particular industries—such as miners and seamen—and some of them are over forty years old. Others, however, are of a universal character. France, at present, possesses the youngest system of old age and invalidity insurance; while Belgium and Austria-Hungary and the three Scandinavian countries have adopted universal schemes, either for old age or sickness, which have now mostly been in operation for some years. Insurance against the risk of unemployment is said to be the most modern form of insurance; and only three States have so far attempted it on anything approaching a general scale. It is at present being tried in Germany by a few Municipalities. One noteworthy fact to which attention is drawn in the report is that up to the present time no English-speaking country has adopted the plan of assisted insurance. The nearest approach to anything of the kind is to be found in New South Wales, where the State contributes to the funds of Friendly Societies with a view to providing benefits for their aged members and sick pay for members who are granted such benefit for more than twelve months. In Germany, there are compulsory schemes of insurance for sickness and old age and invalidity, as well as for accidents; but to the latter employees do not contribute. As to mutual accident insurance, the only country from which data are available is Austria, where there is a compulsory system in vogue enforced upon nearly 3,000,000 employees, excluding miners, and to which the employers contribute nine-tenths and the employees one-tenth.

Pragmatic Municipal Treasurers.

The Institute of Municipal Treasurers and Accountants have no doubt a very useful sphere to fill; but the members in their corporate state seem to have a very liberal idea as to their importance, and as to the sufficiency of their ability to advise, without reference to others concerned, upon changes from the existing order of things. From a paper by Mr. E. W. Jones, the Deputy Accountant to the Barry District Council, on the accounts of gas undertakings (reproduced elsewhere), it is gathered that, as far back as 1908, the Institute referred to proposed a revision of the accounts of public bodies, among them of gas departments; and the Council then submitted to the Board of Trade forms of accounts on the model they preferred. The one suggested for gas undertakings, the Institute thought best for them. That is kind. But we have no knowledge that the Institute, before communicating with the Board of Trade, took counsel on the subject with the Institution of Gas Engineers, the municipal members of which could have given some very valuable advice as to the alterations needed to "best" adapt local authority gas accounts to the requirements of the time. The Council are still awaiting the approval of the Board of Trade. We are afraid they will have to wait some time, as the modification of the form of accounts referring to gas undertakings is only one part of a much larger question that will some day engage the consideration of the Board of Trade. That is, the modernization and amendment of

the Gas-Works Clauses Acts and Sales of Gas Act, the need for which has been acutely felt for many years past. This is the same Institute who appointed a Committee to consider regulations for financial organization and administration in connection with local authorities, the effect of which, if adopted, would place the financial control of every department, whether trading or otherwise, in the hands of the Finance Committee and Comptroller, who would override the powers now exercised by the other Committees and Chief Officers of the various departments. This is a matter that was alluded to in the last report of the Council of the Institution of Gas Engineers. There is no question that the Institute of Municipal Treasurers and Accountants require closely watching to see that, in the effort to get things arranged as they desire, they do not cause mischief that will be difficult of repair.

Income-Tax and Depreciation.

About Mr. Jones's paper, it is, in the main, descriptive. He does not criticize the existing financial conditions and accounts of gas undertakings, or indicate in what way they can be improved. With regard to his references as to income-tax and depreciation, he will find something of interest on the subject in the last report of the Council of the Institution of Gas Engineers; and by consulting the indices of the "JOURNAL," he would learn of several companies (in addition to three Irish ones) who have, after appeal to the Commissioners of Inland Revenue, had allowances made them for depreciation. We do not see why the Institute of Municipal Treasurers and Accountants need to have entered into any arrangement with the Inland Revenue Authorities, under which no percentage allowance is made for wear and tear, but by which the actual expenditure on repairs and renewals of plant may be charged in the accounts as incurred. It is already provided for in the model accounts appended to the Gas-Works Clauses Act of 1871. This, it is patent, is another instance of interference without proper knowledge. Beyond ordinary repairs and renewals, there is an ever-progressive depreciation going on in a gas-works plant, which is better recognized by engineers than by the Institute of Treasurers and Accountants. But while they interfere, and make agreements without consulting experts in such matters, and thus do injury to the undertakings that they in their shortsightedness think they are serving, gas companies and electricity concerns, in addition to the charges in their accounts for ordinary repairs and renewals, are obtaining allowances for income-tax in respect of depreciation. It is time that the trading departments of local authorities did something to put a curb on this pragmatic body. Intentions may be good, but the effects are not of such quality as they would be if the members of the Institute, in their corporate capacity, recognized their limitations, as well as the existence of other interested bodies.

Mr. Edward Allen, M.Inst.C.E., the Chief Engineer of the Liverpool United Gaslight Company, as President, occupied the chair at the annual dinner of the Liverpool Engineering Society last Thursday.

We learn that it was decided at last week's meeting of the Council of the Society of British Gas Industries that the annual meeting will be held at Leeds (probably) on the 3rd and 4th of March. It is intended to include in the business of proceedings a visit to the Leeds University, with special reference to the Department of Fuel and Metallurgy and Gas Engineering.

Before the Paris Academy of Sciences a short time ago, M. Lanfry directed attention to a new thiophene compound ($C_{10}H_6S_2$) and some of its derivatives. It was isolated from the products of the reaction of sulphur and naphthalene vapour when passed through an iron tube at a red heat. Its composition was stated to be probably either phenothiophene or phenodithiophene.

We are pleased to hear from Dr. Bone that twenty students were enrolled for the special lectures, on "The Distribution and Uses of Coal Gas," at the Leeds University, which commenced on the 11th inst. Though the number is rather smaller than in previous years, it is gratifying to find that those who have taken up the study of this subject give promise of good work being done.

Dr. Bone, of Leeds University, delivered a lecture in Glasgow last Friday to members of the West of Scotland Iron and Steel Institute, on the subject of "Producer Gas from the Point of View of Steel-Works Requirements." The lecturer indicated what in his opinion was the best chemical composition of producer gas for steel furnace requirements; and he discussed in detail the chemistry of the gasification of coal by means of a steam and air blast. He dealt also with the latest developments which have taken place in gas-producer design in the way of mechanical charging and the mechanical removal of ashes.

GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 249.)

ON the Stock Exchange last week the chief feature was the continued upward movement of the high-class investment securities, the strong demand for which carried them up to prices considerably above any attained for months past. All went merrily until it became clear that the Bank rate was not to be lowered; and then some extent of realizing set in and took the cream off the prices of many. But Railway secured issues still showed great strength; and no great damage was done. Meanwhile, in the usually active speculative lines, business was quieter and duller. The start was bright and cheerful on the opening day. Government issues were very firm. Consols rose $\frac{1}{8}$; Corporations and Railway secured were higher; and the ordinaries were firm. On Tuesday, the demand for choice things was in full swing. Many of the gilt-edged division had nice advances; but Consols were unchanged. Rails were firm; Americans recovered; and the Foreign Market had strong points. On Wednesday, business was still fairly active, but not quite so good in the lines which had been rising so freely. Consols did not move. On Thursday, the advance was decidedly checked, and profit-taking began. Consols were $\frac{1}{8}$ lower, and other gilt-edged more sedate. Home Rails were less buoyant. Friday—nearly always a selling-day—left markets generally weaker. Consols fell $\frac{1}{8}$; but Railway secured showed strength, and the ordinary amended before the close. There was not much doing on Saturday; but the tendency was rather better. Consols were steady; and the Railway Market was firm. In the Money Market, the first state was easy; but later on there was a marked change, and discount rates hardened materially. Business in the Gas Market was bright and active, and prices were very firm, although there were not many changes in quotation. Announcements in relation to the working and the profits of the past half year are beginning to come out, and are very gratifying thus far. Gaslight and Coke increase their carry-forward by £83,000. In the market, the ordinary was dealt in at steadily hardening prices, which rose from 106½ on Monday to 107¼ on Saturday—the quotation gaining ½. In the secured issues, the maximum was done at 87½, the preference at from 103¾ to 105, and the debenture at from 78⅞ to 80. South Metropolitan was firm and more active at unchanged figures—121⅛ to 122½. The debenture realized 79½ and 80. In Commercials, the 4 per cent. marked 112, and the debenture 79. Among the Suburban and Provincial group, Alliance and Dublin marked 81⅜ and 82⅛ (a rise of 1), Brentford new 198¼, British 44⅜, Brighton original 220, Ilford debenture 96½, South Suburban 120½ and 121½, and Tottenham "B" 113⅛ and 114⅜. On the local Exchange, Newcastle marked 102—a fall of ½. In the Continental companies, Imperial was done at from 185 to 186, ditto debenture at 95, Union at 90 and 91, ditto preference at 135 and 135½, European at from 24¼ to 24½, and ditto part-paid at 18⅜ and 18 $\frac{3}{16}$—a rise of ¼. Among the undertakings of the remoter world, Bombay new made 5¼, Buenos Ayres 96¼ and 96¾, Monte Video 12½ and 12⅝, Oriental 138¾, Primitiva from 7⅜ to 7 $\frac{11}{16}$, ditto preference from 5¼ to 5⅜, ditto debenture from 96 to 97, and San Paulo 15⅝.

ELECTRICITY SUPPLY MEMORANDA.

Drapers and Electrical Misdemeanours—Gas-Pipe Fusing—Electric Cooking and Heating Imperfections—The Capricious Electric Meter—The Report and the Truth—Glare—The Popular Accuser.

So far as drapers are concerned, electricity has been completely disgraced; and there is a general feeling that on the point of safety they have been duped by the electricity suppliers. Electricity has been proved to be anything but an innocent servant that could do no harm; and there is a fast spreading conviction that it is the most insidious of all lighting agents—an agent that is prone to mysterious escapades at most unexpected times. Not only has it been found creating fires with considerable frequency in drapery establishments—destroying both life and property—but it has (as an article reproduced in part in last week's "JOURNAL" from the "Drapers' Record" shows) a very nasty fancy for puncturing gas and water pipes, and causing trouble. The whole matter is a very serious one; and the Drapers' Chamber of Commerce have been inquiring into the matter, with expert assistance, and what was suspected has been proved to be very real. In the "Drapers' Record," too, an illustration has been given of the elaborate precautions that it has been thought fit to take in wiring the new premises of Messrs. Arding and Hobbs, which are the monument in Clapham to the terrible sacrifice of life and property on the same site by the dropping of an electric lamp. The great feature of the installation is said to be that every inch of wire is protected by heavy steel barrel, screwed at the joints and earthed. Flexible cords have been altogether dispensed with, except in the case of single pendant lamps. No longer are there lamps allowed inside the windows. The details of the scheme are most elaborate; and all with an eye to getting the maximum of protection that human ingenuity and present knowledge can suggest. The insurance companies, the Battersea Electricity Department, the consulting engineer to the electrical contractors have all much at stake in connection with this installation. With it all, there is not complete certainty. But drapers on whose premises the electric light is used, but where all the precautions that have been taken at

Messrs. Arding and Hobbs are not to be found, will, on reading about the latter, look upon their own equipment with still more distrust and disturbance of mind. But, after all, the elaborate precautions taken with the wiring do not cover the real cause of the disaster just before Christmas of 1909. Although lamps are not in the windows in the new premises, there are lamps inside the shop, and plenty of combustible material is near at hand.

Speaking of the insidious character of electric current that has wandered from its particular habitat, reminds of the explosion that occurred in the Camden Town district of the Gaslight and Coke Company last Tuesday. There was, as the result of the explosion, a certain amount of dislocation of normal conditions in and about an electric pavement box; and some of the daily newspapers freely reported the occurrence as a gas explosion. In this they were not far wrong; but there was an important omission in not mentioning that there was no escaping gas until there was electrical fusion of a gas service-pipe. That is a danger to which gas-pipes are seriously exposed in these days; and, unfortunately, it may be expected that there will be more frequent occurrences of the sort in districts where age is telling on electrical distribution systems which were laid in a cruder fashion than is, or should be, customary to-day in the streets of our cities and towns.

A further attempt has been made by the "Electrical Times" to incite interest in electrical cooking and heating. Whether or not there is success, it must be acknowledged that the articles on "Electric Cooking and Heating" that have been published by our contemporary are decidedly interesting. Knowing something about the subject, we feel more attracted by a writer who says things in connection with it are not altogether as an electrician could wish, than by the writing of those who, with a sort of boyish enthusiasm and optimism, throw their caps in the air, and cry that "in a short period it will be all over with gas cooking and heating." This particular writer calls himself "A Domestic User." But he is a good deal more than this. His articles show such an intimate acquaintance with electric heating and cooking arrangements that, if they can succeed, they should do so in such expert hands as his, and such hands, too, should be able to rectify things when they go wrong without having to specially call in an outside electrician for the purpose. Experience of this writer with electrical appliances at home extends over fourteen months. He thinks electricity at 1d. per unit will compare favourably with gas at anything over 2s. 6d. per 1000 cubic feet, and in practice may prove as cheap when the current costs 1½d. per unit, provided that full advantage be taken of its possibilities. This seems to be a point on which his information is seriously at fault. It is acknowledged by him that "if electric cooking and heating devices are to become sufficiently popular to affect the supremacy of gas apparatus, very substantial progress must be made in their design." It is, he also admits, "useless to advocate electric cooking for universal application, unless the apparatus will stand up against the same conditions as are met with by the gas cooker. It must withstand daily use by careless and inexperienced operators year in year out, without more attention than occasional adjustment and cleaning." He acknowledges that gas-stoves do not frequently break down, and that they will last for years. He speaks of the "vices" of gas-cookers—lighting-back, variable gas pressure, extinction of the gas by draughts, the consequent poisoning of the viands, and perhaps explosion—which have not been encountered by us in a great number of years' experience, and which have caused no interruption in the progress of the gas-cooker in popularity. But with all its vices, he gives the gas-cooker its due of pulling through somehow in its service when such irregularities (very infrequently) do arise; whereas when a breakdown occurs in an electric cooker, the cooking operation comes to a dead-stop, and there is a job waiting the convenience of the expert electrician. Apart from costs, apart from the difference in the B.Th.U's. purchasable for a given sum from respectively gas and electricity suppliers, it is clear that electrical cooking appliances have a long way to go to get to the pitch of practical efficiency for everyday work attained by gas-cooking devices. Referring to electric radiators, he says that heating lamps may have, as claimed, a useful life of 800 to 1000 hours, but used fourteen hours a day through the winter (a fair figure where electric heating is depended upon entirely), this limit is soon reached; and in continuous service it is doubtful whether their life averages anything longer than 500 to 600 hours. The provision of new heaters in several four-lamp radiators at 4s. apiece is a serious item, and has no parallel in the gas-fire.

Much the same tale was told by Mr. Harold Gray in a paper read last Tuesday before the Manchester Section of the Institution of Electrical Engineers. It has taken the electrical profession a long time to wake up to the fact that their bygone attestations regarding the efficiency of electrical cooking apparatus were mere fallacies, which to-day do not speak highly for the amount of intelligence that was brought to bear in forming judgment. If this is not the proper representation of the position, then there is only one alternative; and it is that untruths found too ready a flow from their mouths and pens in their commercial zeal. Mr. Gray fairly names five essentials in electrical cooking appliances: (1) Reliability of apparatus, (2) efficiency, (3) utility, (4) cost, and (5) expense of electrical energy. The question of reliability is an important one. To the ordinary domestic user, an electric cooking-stove is something that is fearfully and wonderfully made; while it is necessary, considering the variety of intelligences that have to operate such appliances, they should be simple and robust. The character of the appliances, too, is favourable to breakdown; and the electrical engineering attainments of the ordinary domestic are not of a kind that assist in the prevention or the rectifying of the disorders to which electrical appliances are subject. One of the easiest things in the world is to say what is required; but the achievement is this instance is a totally different matter. So far as can be seen, unless some radical change in idea is forthcoming, initial cost, simplicity, and strength will never run parallel with the characteristics of gas-cooking stoves. In the condensed report to hand of Mr. Gray's paper, he does not appear to hold out any great hope of equality with gas-stoves in these respects. Nor are his remarks particularly encouraging as to competition succeeding with gas on the cost point of view, inasmuch as he readily admits that four times more heat is available from gas than from electricity. In this, he is evidently comparing a unit of electricity with a pennyworth of gas. The measure of the lead that gas has in this respect, of course, depends on its price. It is impossible on the heat basis to effect any comparison between the two agents. What Mr. Gray therefore advocates is that work should proceed to gain the highest possible efficiency from electrical cooking appliances to annihilate the heat advantage that gas has over electricity. Nothing short of a miracle can produce through the appliance itself a condition in efficiency that will compensate for 75 per cent. difference in thermal value; and Mr. Gray's idea is apparently founded on the view that the ultimate efficiency of the gas-stove has been reached. While he speaks with a half-hearted vein of loftiness of what has been done in producing improvement in electrical cooking appliances, the whole tenor of the paper is that there is yet much to be done. After he encourages great expectations if cooking appliances can attain the ideal in efficiency and structural robustness, the electrician receives a douche of cold water by being told that a charge of a penny per unit for heating would still confine use to well-to-do people, and that a lower price than this is therefore imperatively necessary. Two or three places, it is understood, have adopted the price of ½d. per unit. We wonder whether that marvellous thing the load factor has been taken into account in fixing this price. We hope the electrical papers will all reply at once, as their contradictions of each other are sometimes helpful in relieving one of consideration of the argument to be adduced in answer to their replies.

Last week there was a reference to the idiosyncrasies of electric slot meters; and there has since been interest and amusement experienced in reading an article by "Gryphon," in the "Electrical Review," on ordinary meters. The writer is frank throughout the article; he is more especially so in his introductory words when he says that the managers of electric supply undertakings look upon meters as a necessary nuisance. There was a time when the gas manager had much more trouble than now in connection with gas-meters and consumers' complaints of large consumptions. Those experiences were chiefly in the days when half-a-dozen of the old gormandizers, flat-flame burners, would consume anything between 30 and 40 cubic feet of gas an hour. But with the rise of incandescent burners and the continued improvement in their efficiency, although gas cookers and gas-fires have been largely introduced, the gas manager has, in his relations with the consumers, a much more peaceful time than of yore. He has not a meter in use that is not officially tested and stamped, and that is more than the poor electricity supply manager can say. He appears to have many humiliating experiences, at interviews with consumers, through the freaks of meters; and he finds explanations somewhat difficult when accounts jump up in an alarming fashion—in known cases by some 300 per cent. The consumer is genuinely irritated by the vagaries in the supply of current; and if he gets annoyed too by the caprices of the meter, the electricity undertaking stands a good chance of losing him, and more so now that the means of gas illumination have made such remarkable progress in wiping out the features that at one time weighed against it in the eyes of some gas consumers. "Gryphon" recommends that very strict guard should be kept over consumers' meters. His recommendation is that frequent inspection and the insertion of check meters should be adopted with the view of catching the others tripping. The metering of electricity already costs a considerable sum of money. The protective scheme of the writer would cause it to cost more; and consumers would become very suspicious of any tinkering about in the neighbourhood of their meters between accounts. But "Gryphon" advises that, when a check meter is used, and the old meter is undoubtedly at fault, there is plenty of time to nip it out, and insert another, and leave the check in to the end of the quarter. In the case of power consumers, too, he thinks it most advisable not only to take frequent readings, but to permanently insert one or two check meters, and take the mean of their readings, also testing them from time to time. Reliability is not a virtue that can be claimed any more by electricity meters than by other forms of electrical appliances.

The loose way in which statements are made in certain of our electrical contemporaries in referring to gas matters is exemplified by a paragraph on the gas supply of Eastwood that has appeared in the "Electrical Times." It states that the residents of that suburb of Nottingham "are heartily sick of the insufficiency of their gas supply;" and the Clerk to the Council has been instructed to obtain particulars as to the cost of establishing an electric supply scheme. It is added that "the gas supply is in the hands of the Nottingham Corporation, which, it is stated, has made no efforts to deal with complaints from Eastwood extending over several years." There is a great deal of discretion displayed in the words "it is stated." The facts are these: The Eastwood Urban District Council some time ago called in an expert, with a

view to advising them on the pressure and quality of the gas in their district. They, however, altogether disregarded his report, which entirely exonerated the gas supply, and felt satisfied in abusing the latter. When the officials of the Nottingham Gas Department have had specific complaints from Eastwood, they have been investigated, and satisfaction given to the parties complaining. But, of course, when a general complaint is made without any specific particulars—such as the name and address of the consumer—it is hardly possible to give the assistance that the officials always desire to render. That is a very different tale from the one presented by the "Electrical Times."

In a further reference to the affairs of the electrical industry during the past year, the "Electrician" makes reference to that evil of metallic filament lamps—glare. It is glare here, glare there, and glare everywhere when such lamps are in use; and our contemporary has such a steadfast solicitude for the electric industry, that it desires to see the problem attacked before users with impaired vision throw over electric lighting in their despair. It says: "Although the theoretical side of the subject appears to be well-understood by engineers, a vigorous campaign among the general public—especially tobacconists, cheap tailors, drapers and proprietors of picture palaces—is necessary if the eyesight of the man in the street is to be preserved. The arrangement of the lighting units in private houses, halls, libraries and other similar places also requires attention." There is evidently plenty of work to be done. Meanwhile, electric undertakings should be swelling their income by commission from oculists and opticians.

In our editorial columns last week, there was a protest, under the heading of "Bearing False Witness," against popular article writers who are terribly obsessed by legends regarding gas, and gaily republish them as being worthy of as much acceptation as the four gospels. The popular article writer particularly in question has one redeeming feature. Though it is written in the "Girl's Own Paper" for January that gas wickedly destroys life, furniture, pictures, and complexions, causes ancient china plates to fade, and creates some mysterious fluffy kind of dust, electric light has nothing to brag about in the view of the same writer, as is seen from these pithy sentences: "Electric light is very trying and often injurious to the sight, as those who use it continually in city offices know full well. Also, it is a particularly unkind, unsympathetic sort of a light, showing people off to the worst advantage, shedding a hard, uncompromising glare that is all very well in railway stations and public buildings, but in our homes we often feel we need something much more mellow and softening. Moreover, there is a certain element of danger in the use of electric light, which, though it may be reduced to the minimum, is there nevertheless if the best workmanship be not put into the fittings. Of course, one knows there is also an element of danger with gas; but then we have had gas so much longer in our houses; and we know more certainly what to do in case of leakage or accidents of that kind. But most of us are in a dilemma if wires fuse, or anything goes wrong with the electric light." The writer advocates a return to the dim religious light of the candle, which, if there is a modest movement of the air, smokes, flickers, and gutters in a most indecorous and unpardonable manner. The writer, however, has got hold of a few notions respecting electricity that have the charm of being a little more modern than those that are affixed to gas.

According to "The Times," the first of the three batteries of 150 bye-product coke-ovens which are being erected in West Cumberland has just been started at Moresby. The Harrington and Allerdale Coal Company's batteries are expected to be ready in June; and it is estimated that the output then will be 350,000 tons of coke, 6500 tons of sulphate of ammonia, and 23,000 tons of tar annually.

We have received from the Editor (Mr. S. Edgecumbe Rogers) the "Local Government Annual and Official Directory" for the current year. The main portion of the book is devoted to the directory, which gives the names and addresses of the chief officials of all the corporations and local and other authorities throughout the kingdom, as well as a list of the Borough Councils and City Companies of London. A feature which will be found useful is the insertion of the names of the Chairmen of Committees in the Metropolitan boroughs; also the Chairmen of the London County Council Committees. In addition to the directory, there is a quantity of information relating to electric light undertakings in the London boroughs; the charges for gas and water are shown; and there is a useful abstract of local government legislation in 1910.

The underpinning of a masonry conduit, two 48-inch cast-iron water-mains, and one 72-inch steel lock-bar pipe-line is to be undertaken in connection with the building of the new Richmond Hill trunk sewer now being constructed in the borough of Queens, New York City. The existing water-works structures are part of the supply system for Brooklyn, and the sewer will be carried under them in a double-barrel inverted syphon. It is proposed to put in pile footings on either side of the conduit to carry the ends of two heavy steel box girders, each about 46 feet long and slightly less than 5 feet deep. From these girders there will be hung by 1-inch steel rods 26 inch I-beam stringers, which will support the bottom of the conduit at intervals of 2 feet. Wooden sheeting is to be driven along either side of the conduit, to allow the underpinning to proceed without removing the earth cover from the top and sides of the conduit.

PERSONAL.

At their meeting on the 10th inst., the Directors of the Reading Gas Company appointed Mr. A. B. Stedman Secretary and Accountant to the Company. It may be remembered that on the removal of Mr. Canning Williams to Edinburgh, Mr. Stedman was provisionally selected to fill the vacant position.

Mr. Charles Comins, F.C.A., who is known to many of our readers from his former association with Mr. Schultz, at No. 50, Cannon Street, E.C., has been selected by His Majesty's Treasury to act as a public auditor for the purposes of the Friendly Societies Act, 1896, and the Industrial and Provident Societies Act, 1893.

Among the New Year's honours recently announced was that of knighthood conferred on Mr. William H. Lindley, of Frankfort-on-the-Maine, for his distinguished services in connection with the work of the Royal Commission on Canals and Waterways. Sir William H. Lindley is well known on the Continent as one of the most active members of the German Association of Gas and Water Engineers; and his services in connection with water supply, &c., had already been recognized by that body by the award to him of its Bunsen-Pettenkofer medal of honour. He is now a Vice-President of the Association.

It has already been intimated that the services of Sir William H. Stephenson (the Chairman of the Newcastle-upon-Tyne and Gateshead Gas Company) to Newcastle were to be publicly recognized by the presentation to him of the honorary freedom of the city, which was conferred upon him by resolution of the Town Council on Oct. 6 last year. The ceremony took place on Monday afternoon last week, at the Town Hall, in the presence of a large and influential gathering of citizens. Sir William, as readers may remember, is Lord Mayor; and the presentation of the beautiful casket containing the resolution—a tastefully illuminated scroll—was made by his deputy (Mr. Charles S. Shortt), who referred in eulogistic terms to the large-hearted work of the recipient. Sir William expressed his thanks in an interesting speech, in which he dealt with the work of municipal corporations. At the close of the proceedings, hearty cheers were given for "Newcastle's youngest freeman" and for the Lady Mayoress (Miss Stephenson). In the evening, the Lord Mayor was entertained at a banquet at the Westgate Road Assembly Rooms, at which there was a brilliant and representative assembly. It may be mentioned that Sir William has been for forty-two years a member of the Corporation, and has been six times elected Mayor.

OBITUARY.

Mr. John William Bray, the eldest son of the late Mr. George Bray, and Chairman of Messrs. George Bray and Co., of Leeds, died last Sunday week, at Scalby, near Scarborough. The cause of death, at the early age of 36, was appendicitis, for which an operation was performed. Mr. Bray, who leaves a widow and four children, was a Governor of Leeds University, and was a member of the Advisory Committee in connection with the Livesey fund. The funeral took place at Scalby last Wednesday.

The "Journal für Gasbeleuchtung" reports that the death occurred on the 17th ult., of Herr Georg Buhlmann, of Grosslichterfelde, near Berlin. Herr Buhlmann came of a Crefeld family which had for over 150 years been interested in the textile industry; and his early work was in connection with that industry. About 1896, however, he turned his attention to the fabrics used in the manufacture of incandescent mantles, and was instrumental in introducing on a manufacturing scale the use of ramie fibre, in place of cotton. He was for eight years in charge of an incandescent mantle factory in Germany, and continued to the last to take an active part in the improvement of mantle manufacture. He was born on Sept. 17, 1845. Our German contemporary says that deceased did not benefit financially to the extent he deserved from his work and inventions in connection with incandescent gas lighting.

The death occurred last Thursday, at the advanced age of 85, of Mr. Edward Filliter, who was for some time associated with Mr. Henry Rofe as a water engineer in Leeds. He received his training under the late Mr. Thomas Wicksteed, a well-known engineer in his day, and went to Leeds in 1856 to take the position of Borough Surveyor. After about eleven years, he was able to relinquish this position, and devote himself entirely to water-works undertakings; the most important being the Washburn Valley scheme and its subsidiary works, on which he was continuously, for about twenty years, employed by the Corporation. One of his first achievements, soon after he became an official of the Municipality, was to put down the present Cornish pumping-engine at Arthington. He also introduced the system of filter-beds at Weetwood, constructed the high-service reservoirs at Bramley and Moortown, and erected the pumping-station at Headingley to supply these reservoirs from the filter-beds. His scheme of reservoirs in the Washburn Valley was carried out in conjunction with the late Mr. Thomas Hawksley; but the later and auxiliary work which he had recommended at Eccup was entrusted to him alone. Besides his work for the Leeds Corporation, he carried out water-works extensions at Saltburn, Ilkley, Keighley, Wakefield, and elsewhere. He left Leeds in 1886, and came to live in Hampstead.

GAS LEGISLATION FOR 1911.

[Fourth Article.]

We have arrived now at the Provisional Orders for which applications have been made to the Board of Trade and the Local Government Board under the Gas and Water Works Facilities Act, and to the Secretary for Scotland under the Private Legislation Procedure (Scotland) Act, 1899. The number of the Orders dealing with gas affairs is somewhat large, indicating that this method of supplementing powers or obtaining special protection and authority is gaining in favour. The Preesall Gas Order has been dropped.

The Alfreton Gas Order is particularly short. It is to authorize the Company to purchase a scheduled piece of land, containing 12,437 square yards or thereabouts, on which to construct works for the manufacture and storage of gas and residual products. To the purpose of the Order, the Company ask to be authorized to apply any sums of money which they have already raised, or are authorized to raise, under their Act of 1901. [*Parliamentary Agents : Messrs. Rees and Freres.*]

The Barnstaple Gas Company are desirous of extending their area of supply so as to include the parish of Instow; and within the extension they ask to be empowered to charge an amount not exceeding 6d. per 1000 cubic feet beyond the price for the time being charged within the limits of supply as defined by the Act of 1869. Additional capital powers to the extent of £15,000 are requested; and it is asked that this capital shall be issued in accordance with the provisions of sections 10 to 15 of the Company's Order of 1895. Limits of dividend of 7 per cent. and 6 per cent. are named respectively for issues of ordinary and preference capital. The Company wish their borrowing powers to equal (including the sum already borrowed) one-third part of the capital issued under previous and present authority. The prescribed illuminating power of the gas it is now proposed to place at 14 candles, tested by the "Metropolitan" No. 2 burner; and consequently it is asked that so much of section 22 of the Order of 1895 as prescribes 15 candles shall, from the expiration of three months from the commencement of the present Order, be repealed. Among ordinary clauses is the prepayment meter one. A standby clause seeks protection in respect of both gas and electricity installations. Provisions are included for the protection of the London and South-Western Railway Company. [*Parliamentary Agents : Messrs. Torr and Co.*]

In the draft Order introduced by the Burnham Gas Company, the district of supply in relation to which powers are sought is described as Burnham-on-Crouch, and the parishes of Creeksea, Althorne, and Latchingdon, all in the county of Essex. It is proposed that the share capital of the Company shall be £11,000, consisting of £5000 already raised, and to be known as the original capital, and additional capital of £6000. The new clause referring to issues by auction and tender is to be applied to the additional capital. The dividends named are 10 per cent. on the original capital, 7 per cent. on the additional capital raised as ordinary, and 5 per cent. on the part issued as preference. The general limit of one-third part of the capital raised is set to the borrowing powers, with interest restricted to a maximum of 5 per cent. In a schedule, lands are described which it is desired to lease or acquire for manufacturing and storage purposes. The standard illuminating power proposed is 14 candles, tested by the "Metropolitan" No. 2 burner; and it is contemplated that the price shall not exceed 4s. 9d. per 1000 cubic feet—provision being made for the subsequent alteration of the maximum price or the substitution of a standard price and sliding-scale. Other clauses are as usual. [*Parliamentary Agents: Messrs. Lees and Co.*]

The Busby and District Gas Company are forward with an Order to empower them to maintain and continue their existing works in the parishes of Cathcart and Mearns in the county of Renfrew, and to supply gas within part of the parish of Mearns and parts of the parishes of East Kilbride and Carmunnock in the county of Lanark. The proposed capital is £10,000, and the standard rate of dividend 5 per cent. Borrowing powers are to be limited to the customary one-third. Land and works and several other clauses are all of the ordinary type. The illuminating power prescribed is 14 candles, using the "Metropolitan" No. 2 burner. A standard price of 5s. 5d. per 1000 cubic feet is proposed, with the sliding-scale operating up and down on the usual terms. Reserve and special purposes funds are provided for; and in regard to the carry-forward of divisible profits, the sum is not to exceed the amount required to pay a year's dividend at the prescribed rates. The Company desire that, notwithstanding anything contained in section 35 of the Gas-Works Clauses Act, 1871, the annual statement of accounts shall be made up to May 31 each year, and be forwarded to the local authority within the limits of supply on or before Sept. 1 following. [*Parliamentary Agent : Mr. John Kennedy.*]

The Cannock, Hednesford, and District Gas Company, Limited, are asking for an extension of their limits of supply so as to include part of the parish of Norton-under-Cannock known as Norton Canes, the townships of Essington, Hilton, Shareshill, Saredon, Hatherton, Huntington, and the parish of Teddesley Hay, the township of Brocton and the Hazleslade ward of the parish of Brereton, all in the county of Stafford. Further share capital powers are requested not exceeding £40,000, to which is attached the proviso that the share capital shall not exceed in the whole £80,000. The new clause controlling sales by auction or tender is to apply to the additional capital. The proposed limits of dividend are 7 per cent. on the part of the capital issued as ordinary and 6 per cent. on the part issued as preference. Only one-fourth borrowing powers are desired. Special purposes and reserve funds are provided for. The amount of divisible profits carried forward is to be limited to an amount equal to a year's dividend. Land and works clauses appear. The standard illuminating quality of the gas is placed at 14 candles, tested by the "Metropolitan" No. 2 burner. A standard price of 4s. is proposed, with the dividend varying under the sliding-scale by 3s. 6d. per cent. for every penny change in price. In connection with the prepayment clause, it is proposed that "money placed in a prepayment meter shall be deemed not to have been paid by the consumer to the undertakers until the undertakers or their collector have actually received the same." [*Agents : Messrs. Sharpe, Pritchard, and Co.*]

The Clay Cross Order is mainly for an extension of the limits of supply defined by the Order of 1902, and authorization to raise additional capital. Mr. Thomas Hughes Jackson, who carries on business as the Clay Cross Company, is the surviving undertaker and the present promoter. The extended area includes part of the parishes of Woodthorpe, Heath, Ault Hucknall, and Ashover. Additional capital powers amounting to £20,000 are proposed; but the whole capital is not to exceed £60,000. The limit of dividend on the new capital is to be 7 per cent. The usual one-third borrowing power on the amount of capital raised is requested. Provision is made for special purposes and reserve funds. It is desired that the test-burner shall now be the "Metropolitan" No. 2. The promoter suggests the variation of the model prepayment clause by specifying that "the maximum sum to be so charged shall be at the rate of 1s. 1d. per 1000 cubic feet . . . such sum to include the hire of the meter and the fittings used therewith, or at the rate of 1s. 3d. per 1000 cubic feet, including a cooking-stove." The maximum charge for the hire of a prepayment meter, too, is put at 20 per cent. per annum on the cost. [*Parliamentary Agents : Messrs. W. & W. M. Bell.*]

The East Hants Gas Company are already desirous of obtaining power to raise additional capital. The proposition is that the share capital shall not exceed £30,000, embracing the share capital of £24,050 already raised. The additional capital is to be subject to the new clause for the issue of capital by auction or tender. The limitation in section 8 of the Woolmer and District Gas Order of 1908 with respect to dividends to be made upon capital "shall not prevent the undertakers from making in any year any larger dividend than is in the said section provided which may be necessary to pay a fixed cumulative and preferential dividend of 8 per cent. upon the 'A' shares already issued. Subject to the provisions in section 23 of the Order of 1908 contained, the undertakers shall not in any year make out of their profits any larger dividend on the 'B' shares . . than £10 in respect of every £100 of such capital as is actually paid-up." Borrowing powers at the usual rate of one-third part are asked. [*Parliamentary Agents : Messrs. Blyth, Dutton, Hartley, and Blyth.*]

The Herne Bay Gas Company are forward with a land and works Bill. The land it is desired to purchase or lease has an area of between 6 and 7 acres; and thereon the right is asked to construct and maintain gas-works. [*Parliamentary Agents : Messrs. Sharpe, Pritchard, and Co.*]

The Holyhead and North Wales Gas and Water Corporation are busy with four Orders this session. The first refers to Holyhead; and in it the prescribed area includes the urban district of Holyhead and part of the rural district of Valley. The share capital authorized by this Order is to be deemed to consist of £20,770 already expended (to be called the original capital) and additional share capital not exceeding £9230. The additional capital will be raised under the new clause governing issues by auction and tender. The standard rates of dividend will be 10 per cent. on the original capital, and 7 per cent. on the part of the additional capital issued as ordinary, and 6 per cent. on the part issued as preference. The entire borrowing power is limited to £10,000. Works and land powers are incorporated; and the illuminating quality of the gas is placed at 14 candles, as tested by the "Metropolitan" No. 2 burner. The maximum price of gas proposed is 5s., with provision for an ultimate revision or the substitution of a standard price and sliding-scale. The prepayment and subsequent clauses are all in ordinary terms. [*Parliamentary Agent : Mr. L. W. Byrne.*]

The Hythe and Sandgate Gas Company require additional capital; and they are asking for powers not exceeding in the whole £15,000 by the issue of new ordinary or preference shares, with borrowing authorization to the amount of £5000. Dividends are named of 7 per cent. on such portion as is issued as ordinary capital, and 6 per cent. on the part raised as preference capital. The Order puts us into possession of an unusually condensed, but nevertheless (it seems to us) quite acceptable, standard price and sliding-scale clause:

> The standard price to be charged by the undertakers for gas supplied by them shall be 4s. per 1000 cubic feet, and so in proportion for any less quantity supplied, provided that the undertakers may increase or diminish such standard price, and subject to a reduction or increase in the standard rates of dividend to be calculated as follows: For every penny, or part of a penny charged in excess or in diminution of such standard price in any one year, the standard rates of dividend shall for such year be reduced or increased by 5s. in the £100 per annum: Provided always that the standard rate of dividend payable by the

undertakers in respect of any preference shares or preference stock at any time created and issued by the undertakers, shall not be increased or diminished so long as any such preference continues.

The prepayment clause is also shortened by the omission of a stipulation as to a maximum charge for a prepayment meter without fittings. A change of test-burner to the "Metropolitan" No. 2 is also provided for. [*Parliamentary Agents: Messrs. W. & W. M. Bell.*]

The main purpose of the Launceston Gas Order is to give the Company additional capital powers. It is proposed that the share capital shall not exceed £12,000, consisting of the share capital of £7500 already raised (to be called the original capital), and additional capital not exceeding £4500. The new clause controlling the issue of capital is to apply to the additional capital. The limits of dividend are placed at 8 per cent. on the original capital, 7 per cent. on the additional ordinary capital, and 6 per cent. on any part issued as preference capital. Borrowing powers are desired up to one-third of the issued capital. The purchase of land, houses, and cottages is contemplated; and the customary works powers appear. Tested by a "Metropolitan" No. 2 burner, it is proposed that the standard illuminating power of the gas be 14 candles. The standard price of gas is suggested at 4s. per 1000 cubic feet, with the sliding-scale operating with penny changes on the basis of 4s. per cent. on the original capital and 3s. 6d. per cent. on the additional ordinary capital. The reserve and special purposes funds clauses are included, and so is the limitation of the carry-forward to an amount equal to a year's dividend at the authorized rate. All other clauses are of the customary form. [*Parliamentary Agents: Messrs. Lees and Co.*]

An extension of their limits of supply is the chief purpose of the Order introduced by the Lichfield Gas Company. They wish to carry their business to a specified part of Ogley Hay, within which they desire to exercise the powers referring to their existing area. The remainder of the Order is chiefly taken up with protective clauses in favour of the Staffordshire County Council, the Lichfield Rural District Council, and the owners of minerals. [*Parliamentary Agents: Messrs. R. W. Cooper and Sons.*]

A second Order introduced by the Holyhead and North Wales Gas and Water Corporation, Limited, alludes to the gas supply of Llangefni in the county of Anglesey. It is proposed that the share capital for the purposes of this undertaking shall be deemed to consist of £2247, and of additional capital not exceeding £2753, to the issue of which the new auction and tender clause is to apply. The dividends proposed are 10 per cent. on the original capital, 7 per cent. on the additional capital, and 6 per cent. on such part as is issued as preference capital. It is suggested that the borrowing powers shall be limited to £1650, bearing a no higher rate of interest than 5 per cent. Land and works clauses are succeeded by the specification of 14 candles as the standard illuminating power, tested by the "Metropolitan" No. 2 burner. The price of gas is not to exceed 5s. 6d. per 1000 cubic feet, with provision made for revision hereafter, or the substitution of a standard price and sliding-scale. All other clauses are in the usual terms. [*Parliamentary Agent: Mr. L. W. Byrne.*]

An Order on similar lines, emanating from the same quarter, is the one referring to the gas supply of Llanrwst, in the County of Denbigh. It is proposed that the capital shall consist of £7495 (original capital) and £2505 additional capital. The limit of borrowing powers it is suggested shall be £3300. In all other respects the references to the Llangefni Order will apply to this one. [*Parliamentary Agent: Mr. L. W. Byrne.*]

Dr. Bone on Power from Blast-Furnace Gas.

In connection with the Leeds University Engineering Society, a lecture was delivered at the University, on Monday last week, by Professor W. A. Bone, D.Sc., F.R.S., on "Development of Power from Blast-Furnace Gas." At the outset, the lecturer emphasized the great economic importance of the utilization of the surplus energy from blast-furnaces. Out of 800,000 cubic feet of gas which was generated in a certain time in these furnaces, there was, he said, a surplus of about 300,000 cubic feet, which was available for outside purposes. This represented from 2000 to to 2500 horse power of electrical energy which could be utilized continually, night and day. This was very important, in view of the fact that nowadays the greater part of the machinery about steel furnaces might be run electrically. Even then there would be a surplus remaining which would have considerable market value. The available surplus in the Cleveland district alone would amount to 122,000 electrical horse power. When the gas from the blast-furnace was used in a gas-engine, not only did its efficiency prove to be equal to that of the best coal gas, but the slow-burning qualities of the carbon monoxide produced a quieter and steadier running of the machine than did any other gas. Movements were on foot for dealing with these gases; and companies had been formed on the North-East Coast to buy the surplus gases, convert them into electrical energy, and distribute them over the area in which they operated. These companies had met with success; and the small consumer was receiving great benefit, because the power could be supplied to him more cheaply than from even the municipal concerns. So that, with the possibility of marketing not only the iron, but also the gases, he thought it would be possible to economically work deposits of iron ore which had hitherto been left alone; and it might be that the ironmaster would be able, in times of depression, to keep his furnaces going, and make a profit, by the sale of the surplus gas.

TABULAR NUMBERS FOR LABORATORY USE.*

The tabular numbers for the correction of the volume of a gas measured over water at different temperatures and under different atmospheric pressures to the corresponding volume in standard conditions, which have formed an integral part of the Notification of the Gas Referees for many years past, and have been reprinted in the majority of text-books relating to the testing of gas, are generally used in this country. The standard conditions to which they apply are a temperature of 60° Fahr., a barometric height of 30 inches, and saturation with aqueous vapour. These conditions probably represent fairly closely the average conditions of measurement of gas both in station and consumers' meters, and hence bring the results of laboratory testings, corrected accordingly, into close relation with the conditions in which gas is ordinarily measured for works' control and sale. On the other hand, a different, and, we think, less practical, procedure has been generally followed in all gas testing on the Continent, and in academical laboratories in this country. Instead of adopting as standard, conditions which approximate to those prevailing on the works and in the household, Continental gas chemists and engineers have accepted the standard conditions which were, in the first instance, adopted in scientific laboratories for research work dealing with gases of all kinds. These academical standard conditions are measurement at a temperature of 0° C., at a barometric height of 760 mm., and in the dry state. Needless to say, such conditions do not obtain anywhere in actual practice, and are indeed so far removed from practical cases that one cubic foot of gas measured in these academical standard conditions becomes 1·07 to 1·08 cubic feet at ordinary temperatures and in ordinary conditions of measurement. Notwithstanding that the volumes of gas, as corrected to the Continental and academical conditions, are on the average 7 to 8 per cent. lower than the corresponding volumes of gas as measured on a works or by a consumer's meter, the majority of Continental gas men continue to adopt these abnormal standard conditions. To such, and to chemists making researches of a more purely scientific character on gases, the little *brochure* of tabular numbers, with the corresponding logarithms, which is now before us will be useful. It gives the numbers by which a volume of gas measured over water at temperatures ranging from 10° to 25° C., and at barometric heights from 700 to 770 mm. (rising by 1° and 1 mm. respectively), should be divided in order to obtain the corresponding volume of gas at 0° C., 760 mm. and in the dry state. If the result of a test of calorific or illuminating power of gas measured in any conditions comprised within the range of temperature and barometric height stated has to be corrected to the corresponding figure for gas measured at 0° C., 760 mm. and dry, the tabular numbers given are to be used to multiply the uncorrected result.

The tables are conveniently arranged on four openings of the *brochure;* and a note states that if it is desired to obtain the volume at 15° C. (59° Fahr.) and 760 mm. (29·92 inches), and saturated, the volume, corrected to 0° C., 760 mm. and dry by the tabular numbers given, should be multiplied by 1·073. There appears now to be some disposition displayed by Continental gas men to adopt 15° C., 760 mm., and saturated, as standard conditions in place of the academical standard to which the tabular numbers in this *brochure* refer; and since the volume of a gas measured over water at 15° C., and 760 mm. corresponds within 0·002 per cent. with the volume at 60° Fahr. and 30 inches, it is to be hoped that this movement will spread to all Continental gas-works. By this means, carbonizing and testing results obtained on the Continent would be brought into line with those obtained in this country, and would be comparable without the somewhat troublesome corrections now involved. From this standpoint, we may express a hope that Herr K. Ludwig may see his way to prepare a similar set of tabular numbers for the correction of gaseous volumes to the corresponding standard volume at 15° C., 760 mm. and saturated, and so save users who have adopted the latter as their standard conditions the trouble of multiplying by the constant 1·073. We have checked his tables at a number of points and found them correct.

It may perhaps be pointed out that Volume I of the Physico-Chemical Tables compiled by the late J. Castell-Evans, F.I.C., contains, in Tables LIXg. and LIXh., similar tabular numbers, calculated to six figures, for the correction of volumes of gas saturated with water vapour at pressures ranging from 710 mm. to 770 mm., and at temperatures ranging from 0° to 30° C. to the corresponding volume at 0° C., and 760 mm. and dry. These numbers should be the reciprocals of those given by Herr Ludwig. But unlike his, they do not agree exactly with the formula from which they are stated to have been calculated; and it is not evident what further correction (if any) is embodied in them. Castell-Evans's tables make the factor for the conversion of volumes at 0° C., 760 mm. and dry, to volumes at 15° C., 760 mm. and saturated, to be 1·0758 instead of the 1·073 adopted by Herr Ludwig. According to the generally accepted formula, Herr Ludwig's factor is right, and that obtained from Castell-Evans's tables is wrong. Unfortunately, the tabular numbers given by Castell-Evans have been largely used in converting makes of gas reported in Continental terms into the corresponding makes in English conditions of measurement in a good many of the abstract translations made for the columns of the "JOURNAL" in recent years; and an error of 26 cubic feet in 10,000 cubic feet has thus

* "Reduktions-Tabelle für Heizwert und Volumen von Gasen," von K. Ludwig, Chemiker. R. Oldenbourg, Munich and Berlin; 1911.

in these cases been introduced. As we understand that a second volume of Castell-Evans's tables is about to be published posthumously, the Publishers (Messrs. Charles Griffin and Co.) might direct the attention of the Editor to the tables in question in the first volume, in order that some explanation or correction of them may be incorporated in the second volume.

LOCAL ADMINISTRATION.

As readers of the "JOURNAL" may remember, the annual reports of the Local Government Board have grown so bulky of late years, that it has been necessary to issue in two parts the one dealing with the general work of the Board; a separate volume being devoted entirely to the proceedings of the Medical Department. Part II. of the thirty-ninth report, covering the year 1909-10, has lately been published; and, as on previous occasions, we shall reproduce from it certain of the statistics relating to local administration. The various subjects are arranged in three groups: (1) the work of County Councils under the Local Government Act, 1888; (2) public health and local administration; (3) local taxation and valuation. It is with statistics in the last two groups that our readers are specially concerned.

Since the constitution of the Board in 1871, they have sanctioned loans by urban and rural authorities amounting to £190,515,467, of which £6,252,889 was authorized in the year ended Dec. 31, 1909. This sum was divided between the two classes of authorities as follows: Urban district councils, £5,700,432; rural councils, £552,457. Under the Public Health Acts and Local and Confirmation Acts, the Board sanctioned loans to the amount of £4,989,765, of which £134,075 was to be spent upon gas-works, £464,877 on water-works, and £1,257,457 on street improvements. The amount sanctioned for water-works was divided thus: Urban councils, £342,187, rural councils, £122,690. The borrowings by local authorities for electricity supply purposes under the Act of 1882 fell off considerably in the year covered by the report; being only £835,068, compared with £1,377,268 in 1908. The total amount borrowed between 1890 and 1909 (both inclusive) was £26,385,614, the whole of which was required by town and urban district councils, with the exception of three loans authorized to be raised by rural district councils in 1905, 1908, and 1909 respectively. The loans sanctioned to joint boards of united districts (including since 1902 the Metropolitan Water Board) since 1875 amount to £6,473,470; the figures for 1909 being £134,639. There are now 136 of these boards, compared with 16 in 1880. Of the first-named number, 83 are hospital boards. The loans for water supply sanctioned to joint boards during the past ten years amount to £2,617,221, of which £103,427 stands for the year 1909. This includes £69,961 for the Metropolitan Water Board, compared with £722,393 in the preceding year.

Most of the local inquiries held by the engineering staff of the Board are in connection with applications by local authorities for sanction to loans; but many other matters engage their attention. For example, they have to consider appeals against the apportionment of the cost of sewerage or water works between rural parishes, and objections to the construction of these works beyond the limits of the district for which they are required, and also to the construction of reservoirs which will hold more than 100,000 gallons of water. In connection with this work, 1240 inquiries were held during 1909. In addition, a large number of visits were paid with reference to complaints in regard to the sanitary conditions of towns and villages, and appeals by owners against the demands of local authorities for the repayment of the cost of making-up private streets, and the inspection of sewage-disposal and other sanitary works in respect of which the Board had sanctioned loans. Under section 243 of the Public Health Act, 1875, the Board are empowered to recommend the Public Works Loan Commissioners to advance moneys to local authorities for the purposes of that Act; but, by virtue of the Public Works Loans Act, 1898, their recommendation is no longer necessary in the case of such loans, unless the period within which a loan is proposed to be repaid exceeds thirty years. During the year 1909, the Board's District Auditors investigated the accounts of twenty-two special non-Metropolitan gas and water authorities.

In pursuance of the Board's powers under the Public Health Act, 1875, they issued fourteen Provisional Orders for the repeal, alteration, and amendment of Local Acts and Provisional Order Confirmation Acts. Among them were the following: The Coventry Order contained various provisions relating to the supply of gas, including the use of anti-fluctuators for gas-engines, the gas-testing burner, and the specifying of the size and materials of gas-pipes on consumers' premises and the inspection thereof. The Fulwood Order authorized the purchase of certain lands by agreement for the purpose of protecting from pollution or contamination the sources of the water supply of the District Council. The Kendal Order extended the limits of the Town Council for the supply of gas. The Maryport Order authorized the construction of certain water-works, subject to the Board's approval; the formation of reserve funds in connection with the water and gas undertakings of the District Council; and, on the application of that body, the specification by the Board of the rates and charges for a supply of water for domestic purposes, including additional charges for fixed baths and for each closet beyond the first in a house. In the foregoing and other cases, further powers were conferred on local authorities in regard to the gas and water undertakings, including the taking and use of additional lands, the sale of surplus lands and the application of the proceeds, the use of lands for the manufacture and storage of gas and residual products, the supply of gas, and of apparatus, &c., used in its consumption for lighting and heating or other purposes, and other matters. Some of the Orders granted conferred additional borrowing powers. The Maryport District Council were granted a sum of £20,000 in respect of their water undertaking; the Milton Regis Council £2500, and the Oswaldtwistle Council £20,000, in respect of their gas undertakings.

Among the financial, statistical, and other statements in the report is a table showing the loans sanctioned to county borough, town, and urban district councils in respect of their gas and water undertakings during the twelve months ended Dec. 31, 1909. The following were among the loans sanctioned for the first-named purpose: Aberavon, £6929; Atherton, £3667; Beverley, £2800; Birkenhead, £2700; Briton Ferry, £3300; Burnley, £17,074; Guildford, £4064 (to purchase part of the undertaking of the Woking Water and Gas Company); Ilkley, £4243; Kirkby-in-Ashfield, £6000; Mansfield, £9600; Middleton, £13,059; Milton Regis, £2093; Nelson, £2867; Rhondda, £20,949; Rhyl, £3600; Scunthorpe, £5000; Ulverston, £2000; Winsford, £2000; Wolstanton, £4150; Wombwell, £3075. A number of loans were also granted in respect of water supply, the following being the principal ones: Aberavon, £3645; Billinge, £13,000; Bolton, £4000; Cardiff, £2401; Clitheroe, £3400; Dover, £2500; Fulwood £7747; Grange-over-Sands, £5000; Guildford, £3379; Hastings, £1699; Horwich, £2300; Lincoln, £24,227; Llandudno, £5226; Margam, £4041; Maryport, £16,177; Minehead, £3812; Neath, £2815; Northampton, £6900; Paignton, £7966; Preston, £47,989; Rhondda, £5170; Ryde, £3496; St. Ives (Cornwall), £3945; Saltash, £1950; Spalding, £5000; Stevenage, £2600; Swadlincote, £6017; Tunbridge Wells, £3166; Whitehaven, £4957.

As usual, one of the appendices contains the annual report of Mr. Charles Perrin, M.Inst.C.E., the Official Water Examiner under the Metropolis Water Act, 1871. The average daily supply of water in the year ended Dec. 31, 1909, was 226,481,907 gallons, or at the rate of 32·06 gallons per head of the estimated average population.

The section of the report dealing with local taxation and valuation sets forth that the Board prepared and presented to Parliament returns showing, for the financial year 1907-8, particulars of the receipts, the expenditure, and the outstanding loans of each county council, town council, urban district council, rural district council, and board of guardians, together with information as to the financial transactions and outstanding loans of all other local authorities exercising jurisdiction in England and Wales. These returns have recently been so fully dealt with in the "JOURNAL" that it is unnecessary to revert to them.

The "Automaton" Lamp Controller for Purley.

The Directors of the Croydon Gas Company have decided to adopt the "Automaton" lamp controller for lighting and extinguishing the public lamps in the Purley district. This decision has been arrived at as the result of a report by Mr. W. J. Sandeman, the Distribution Superintendent of the Company, on the working of an experimental installation, numbering 32 controllers, fixed at Kenley about fifteen months ago, and on the ultimate saving to be effected by the adoption of the controllers. The total installation, when completed, will number about 350 controllers.

Paris Gas-Works Extensions.—Some months ago, particulars were given in the "JOURNAL" of a large scheme of extensions of the Paris Gas-Works which had been submitted to the Municipal Council by the Paris Gas Company; and in the spring of last year, the Council sanctioned the first group, involving an outlay of 15,281,000 frs. (£611,240). These works were recognized as being urgent; and they were to be undertaken, if possible, during 1910. Others, however, are indispensable; and it is proposed that they should be carried out in the course of the present and following year. They will entail an expenditure of 9,604,500 frs. (£384,180) in addition to the sum already voted. The principal items in the scheme are a new gasholder at Le Landy, the telescoping of one at Clichy, the construction of experimental gas-works at Alfortville, the purchase of coal and oil waggons, and the laying of high-pressure mains. The Municipal Council are asked to vote without delay the amount necessary for these works.

Gaslight and Coke and South Metropolitan Gas Companies' Dividends.—We are informed by the Secretary of the Gaslight and Coke Company, Mr. H. Rayner, that the accounts for the past half year show that (subject to audit) the balance to the credit of the net revenue account will enable the Directors to recommend the payment of a dividend at the rate of £4 13s. 4d. per cent. per annum, carrying forward to the next account £625,688 7s. 4d. The dividend was the same this time last year; but the carry-forward was £456,993. For the June half year, the dividend was at the rate now recommended; and the amount carried forward was £542,370, which included a balance of £32,746 taken over from the late West Ham Gas Company on Jan. 1, 1910. The Directors of the South Metropolitan Gas Company recommend, subject to audit, a dividend for the half year ended the 31st ult. at the rate of £5 9s. 4d. per cent. per annum; carrying forward £85,209. This time last year, the dividend was at the same rate, with a carry-forward of £79,627.

LAYING GAS-MAINS UNDER THE HARLEM RIVER.

By C. C. Simpson, of New York.

At the Fifth Annual Meeting of the American Gas Institute, Mr. Colin C. Simpson, the General Superintendent of the Mains and Services Department of the Consolidated Gas Company of New York, submitted a paper—of which he has sent us a copy, together with a set of the photographs he showed, and some of which are reproduced—describing the arrangements he made for the laying of a 48-inch main and two 36-inch mains under the Harlem River.

The 48-Inch Main.

The 48-inch main was laid for the purpose of ensuring an additional supply of gas for Bronx borough—practically a city of itself, with a population of 430,000. The capacity of the Central Union works, which supplies the entire borough, is 11 million cubic feet per day, with very little, if any, room for extension. The maximum send-out from these works during the winter of 1909-10 was over 10 million cubic feet.

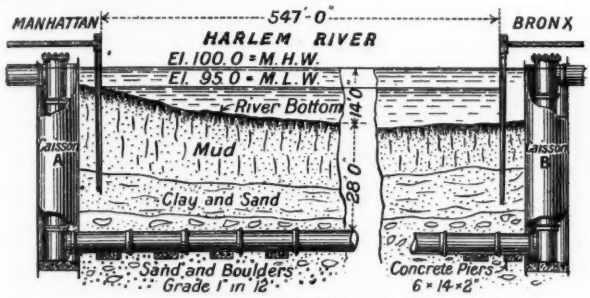


Fig. 1.—Profile of the 48-Inch Harlem River Gas-Main.

From the normal increase of population in this territory (over 10 per cent. a year) it was evident that steps had to be taken to provide an additional supply of gas. This gas (pending the completion of the Astoria to Port Morris tunnel) must necessarily come from Manhattan. Two methods were considered for bringing gas from Manhattan to the Bronx.

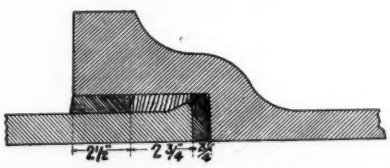


Fig. 2.—Section of Hub and Spigot on the Harlem River Gas-Main.

The first was to build a tunnel under Harlem River from 129th Street, Manhattan, to Lincoln Avenue, Bronx. Through the tunnel a 48-inch line would be run from the end of the present 48-inch main near 129th Street to Lincoln Avenue, and from this point to the Central Union works. The cost of the tunnel—taking into consideration the purchase of sites for the two shafts—would have been not less than $500,000; and the difficulty of obtaining franchises and acquiring suitable property would have made the minimum time of construction two years.

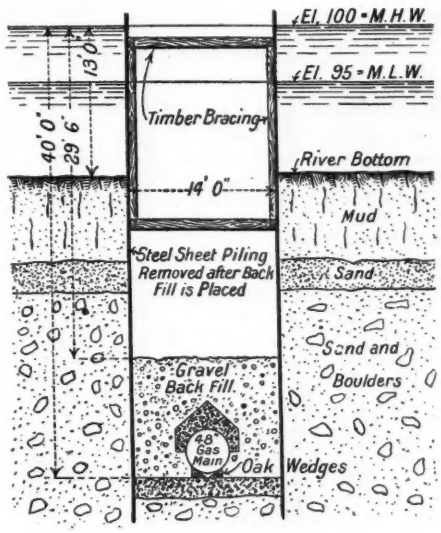


Fig. 3.—Section of River, Showing the 48-Inch Main in the Trench.

The second scheme was to replace the present 20-inch main at this point with a 48-inch main, laying it at such depth below the bed of the river as to ensure against any possibility of damage from the buckets, anchors, or heavy steel-shod-spuds of dredges operating over the line of the main, and also to provide for any future deepening of the channel. The cost of this second scheme would be less than $150,000, and the work could easily be finished in from six to nine months—thus allowing us to furnish gas in this way during the coming winter.

Taking into consideration, then, the items of time and cost, the second method of crossing the river was adopted. The general plan for carrying out this work (see fig. 1) was as follows: Steel caissons, 10 feet diameter, were sunk just at the back of the bulkhead line each side of the river. The bottoms of these caissons were then sealed with concrete; a drip-pot was placed in each; and the standpipes were built up inside. Coffer-dams made of steel-sheet piling, in successive sections, were then driven over the river; the pipe being laid on concrete piers as soon as the material was pumped out. The channel at this point extends 550 feet from bulkhead line to bulkhead line; and as there is a great deal of shipping, it would not be possible to close off more than half the river at any one time.

The pipe used was ordinary water-weight (8400 lbs. per length) hub-and-spigot pipe, the depth of hub being 6 inches. An inside

Fig. 4.—Lowering the First Four Sections of a Caisson for the 48-Inch Harlem River Gas-Main.

joint ¾-inch wide (see fig. 2) was provided by not allowing the spigot to enter the full depth into the bell. As an additional precaution against breakage, and also to weight the pipe, a complete decking of concrete blocks was placed over the main. (See fig. 3.)

The actual work started with the sinking of Caisson A on the Manhattan side of the river. This is composed of sheets of ⅜-inch boiler plates. A guide-frame of 12-inch by 12-inch timbers was erected; and through this the first four sections were lowered, by means of the derrick scow, until the cutting edge had penetrated

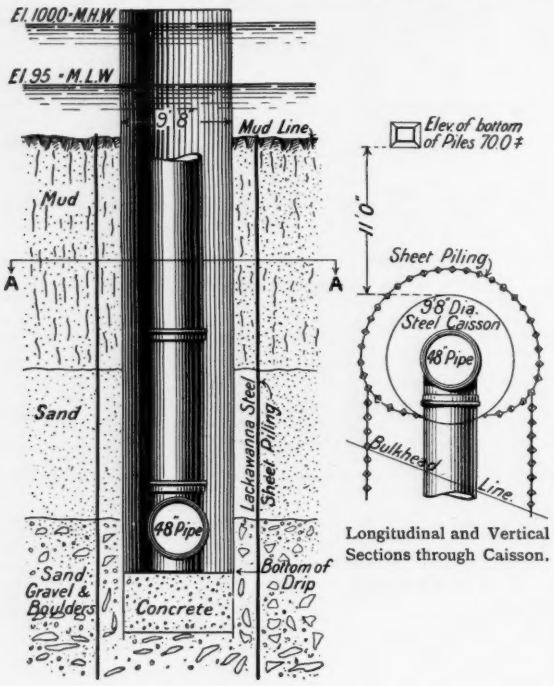


Fig. 5.—Vertical Sheet-Piling Driven to Prevent Possible Settlement.

5 or 6 feet into the mud. (See fig. 4.) Four steel hooks, which had previously been placed under the cutting edge, were then fastened by means of wire cables to four 4-ton differential blocks, which were, in turn, secured to the guide-frame. This scheme permitted us to hold the caisson at any time, to allow of bolting-on additional sections, and also to check the progress should bad quicksand be encountered.

The material inside the caisson was then pumped out by means of an 8-inch centrifugal pump; and a head of water greater than that outside was constantly maintained by pumping in with a 12-inch pump. It was necessary to employ a diver to tend this 8-inch section, and also to loosen up the material by means of a water-jet.

Additional sections were bolted on as the cutting edge was lowered; and on the inside flange of each section a loading platform—holding 10 or 15 tons of pig iron—was placed to help overcome the skin friction.

When the cutting edge was within 6 feet of the final grade, a slight crack was noticed in the street surface near an adjacent elevated railroad column; and levels showed a settlement of this column of about ¼ inch. This settlement was due to a layer of quicksand which we had penetrated; and to guard against any further movement, we decided to drive a tight ring of steel sheet-piling about 6 feet below the final grade of the caisson. Fig. 5 shows the relations of the column sheet-piling and caisson. After the driving of this piling, no further settlement of the column took place; and the caisson was finally sunk to grade. The bottom was then sealed with a layer of concrete and the drip set in place. [Fig. 6 shows Caisson "A" sunk to grade and the first coffer-dam being driven.]

While this work was going on, Caisson "B" on the Bronx side of the river was started. This proved a much simpler matter than Caisson "A," as there was no elevated railroad columns to contend with. The material through which the caisson was sunk was a very sticky mixture of clay and sand. It was impossible to pump this, so a ¼ cubic yard Hayward orange-peel bucket was secured; and the material was excavated by means of this, with very little assistance from divers. When the caisson had reached grade, the bottom was concreted; and work at this point was then temporarily discontinued until the main had been laid clear across the river. As stated before, the large volume of shipping at this point prevented us closing more than one side of the river at a time.

In laying the pipe in the river, the original idea was to dredge an open trench of the required depth, allowing the banks to take their natural slope. It was finally decided, however, on account of the great depth of the trench and the uncertainty as to what angle of repose the material would take under the action of the strong tide, to drive sectional coffer-dams of steel sheet-piling. While this method might have delayed the work a little, it would certainly be much safer in the end, especially as we were unable to obtain any definite information as to the depth of the foundations under two adjacent piers of a heavy railroad drawbridge. An order was, therefore, placed for enough of this piling to sheet 150 feet of trench. Pending the arrival of the piling, we pumped the mud from four high-tension cables which lay directly on the line of our main. Divers fastened these together; and there was fortunately enough slack to allow us to pull them about 15 feet east, so as to leave them entirely out of danger, and clear of our trench. It was necessary to watch these cables very carefully during the entire process, as any break would have made us liable for heavy damages, besides endangering the lives of the workmen.

The river at this point is about 15 feet deep at high water. The permit granted for the main required it to be laid 20 feet below the river bed. This would make the bottom of the trench at the centre of the river (which was also the summit of the main) 42 feet below mean high water. This allows for a concrete pier about 2 feet thick under the pipe. At the shore ends, allowing a grade of 1 inch in 12 feet, the bottom of the trench was 45 feet below mean high water.

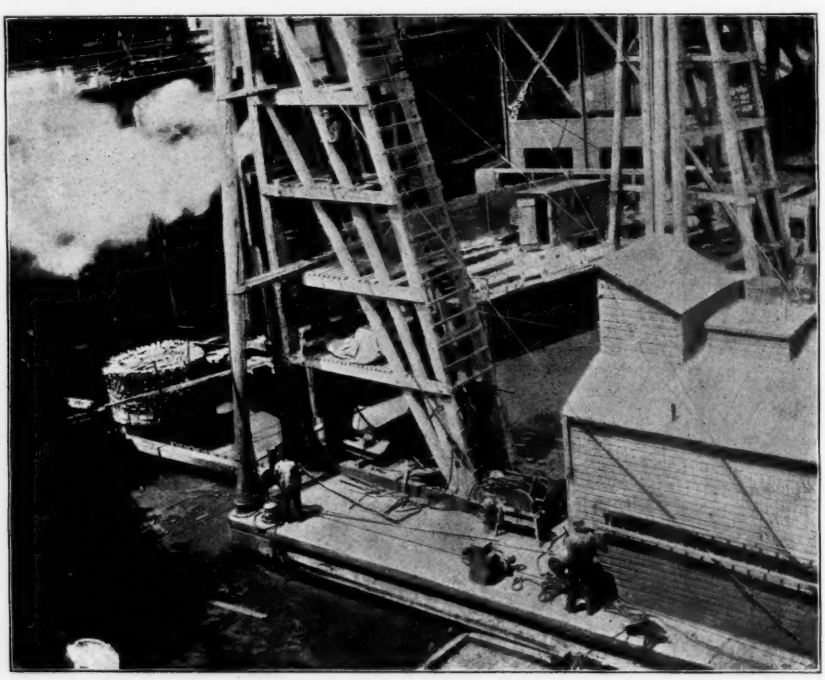


Fig. 6.—Driving the First Section of the Cofferdam for the 48-Inch Harlem River Gas-Main.

The first consignment of piling (in 45 feet lengths) arrived shortly after the cables had been moved, and work was started on the first 130 feet section of coffer-dam. The piling was driven an average of 4 feet below the pumping grade by a Vulcan steam-hammer. The work was rather slow at the start, due to a layer of large boulders underlying the sand; but the section 130 feet long and 14 feet wide was finally driven to grade and pumping commenced. [Fig 7 shows the sheet-piling on this section driven and pumping in progress.] The pumping was done by 8-inch and 12-inch centrifugal pumps worked from the derrick scow, with a diver tending each suction and stirring up the material with a 3-inch water-jet. We were able to take out from 100 to 150 yards per day, until the layer of boulders was reached. Pumping here became rather difficult, and much of the material had to be removed by the divers.

There was originally a rather strong tide at this point; and it became considerably stronger after we had dammed-off part of the river. This necessitated some heavy cross-bracing to keep the sheeting in shape when the trench had been excavated. Fig. 3 shows a cross-section of this trench with the pipe in place, and also the amount of bracing necessary.

When about 20 feet of the inshore end of this coffer-dam had been pumped to grade, the plate over the lower opening in the caisson was removed; the first concrete pier (6 feet long, 14 feet wide, and 2 feet deep) placed; and the first length of pipe lowered and caulked into the drip. The drip was then centred into the caisson, and the standpipe built up. In all cases, in making-up the joints on this line, a pair of $\frac{3}{4}$-inch rods, tapered at the ends, were placed across the hub, allowing for an inside joint $\frac{3}{4}$ inch wide and 2 inches deep. [See fig. 2.] After the outside joint was caulked, these rods were withdrawn by means of turn buckles; and when a section of pipe was completed and pumped out, men were sent inside to caulk these joints. All the caulking, both above and below the water, was done with lead wool and pneumatic tools; considerable time and expense being saved by the use of the latter.

As successive lengths of the trench were pumped out, the concrete piers were placed, and the pipe lowered and set to grade. The pipe was placed two lengths at a time—the two lengths being lined up and caulked on the derrick scow; then firmly strapped to a 15-inch I-beam, and lowered into place. This made it necessary to have only every second joint caulked under water by the divers. [Fig. 8 shows the method employed for the purpose of placing the pipe into the trench.]

In laying the pipe under water, it is usually a rather difficult problem to preserve line and grade; but on this work it was

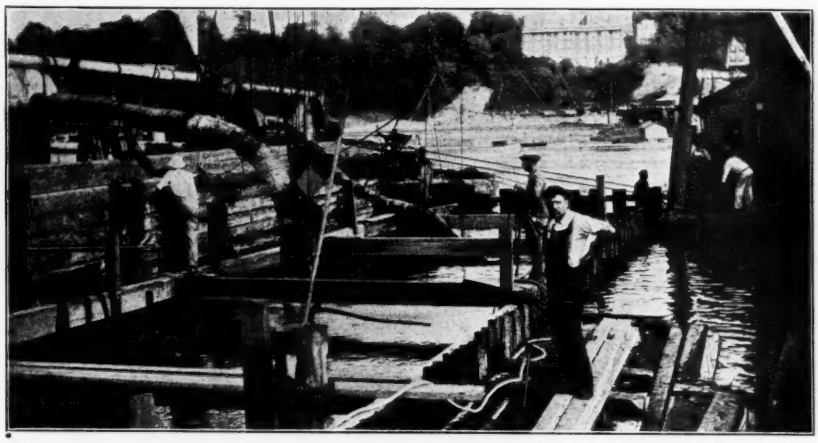


Fig. 7.—Sheet Piling for the Cofferdam for the 36-Inch Harlem River Gas-Mains.

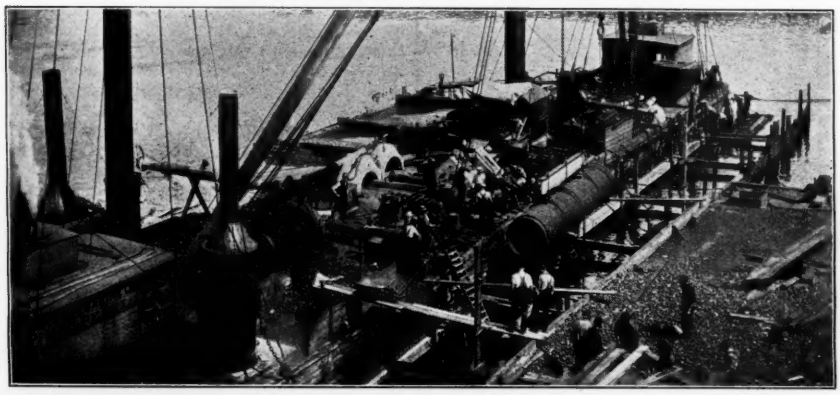


Fig. 8.—The Second Cofferdam for the 48-inch Harlem River Gas-Main, with Pipe being lowered into Position.

simplicity itself. Divers first of all placed heavy wedges under the pipes on the piers. Then, by means of a long rod held on the top of the pipe and read from an instrument on shore, the divers were signalled to at once start to wedge-up until the pipe was found to be at the proper grade; and the line was then checked from the instrument.

After the pipe had all been laid and caulked in this section, the end was closed by means of a plug and a rubber gasket, and the water pumped out. An inspection by the engineers in charge was then made; and the main found to be absolutely tight and true to line. Advantage of this opportunity was taken to caulk the inside joints; and at the same time the concrete protection blocks were lowered into place. As an additional precaution against breakage, the trench was back-filled to a depth of 4 feet above the concrete blocks with gravel. The sheeting was then pulled, and driving started on the second section of coffer-dam.

This second section was driven for a distance of 143 feet, carrying us to the centre of the river. Both the driving and pumping on this section were much easier than on the first; the layer of boulders seeming to thin out toward the centre of the river. The trench was driven, braced, and excavated in precisely the same manner as in the first section; and after the pipe had been laid and caulked, the water was pumped out and a second inspection made. The line proved absolutely tight and correct as to line and grade; so that the protection blocks were ordered, placed and the sheeting pulled.

We decided to make the third section of coffer-dam continuous across the north half of the river, leaving the trench open at both ends and re-driving the sheeting at the north end of the trench, as the pipe was laid and back-filled at the south end.

The Two 36-Inch Lines.

The two 36-inch submerged lines were laid for the purpose of bringing gas to and from the upper Manhattan main system and a new 10 million cubic feet holder.

While the general scheme for this crossing is somewhat similar to that for the 48-inch main above described, there are several points of difference. The river at this point is about 400 feet wide between established bulkhead lines; and for this distance we decided to keep the top of the pipe 20 feet below the river bed. The same danger from dredge spuds and future deepening of the channel existed here as at the point where the 48-inch crossing was made. From the west shore line to the west bulkhead line there is 190 feet of low marsh, about 10 feet below the established street grade. We decided, therefore, to lay the mains on a low trestle over this ground; and to sink the Manhattan caissons at the back of the bulkhead line. From the east bulkhead line to the west line of our holder property, a distance of 620 feet, the land

is owned by the New York Central and Hudson River Railroad. As they expect to drive piles and erect buildings on this ground, it would have been impossible to lay our mains through it on a trestle; so it was decided to take a gradual slope from the east bulkhead line to the railroad tracks, and then pass under these by means of a concrete culvert.

The actual work on these lines commenced with the building of the trestle from the Manhattan shore to the west bulkhead line. The trestle was built to such a grade that, when the street was finally filled in, the mains would lie about 3 feet below the surface. At the outshore end of the trestle, where we expected to sink the caissons, there was but 1 ft. 6 in. to 2 feet of water at high tide; and as all the work had to be handled from scows, it was necessary to dredge out an area about 60 feet by 100 feet. During this dredging, a tough layer of clay and sand was encountered just below the mud line. This would have been almost impossible to pump; so it was decided to have the dipper-dredge to remove this layer for the whole width of the river.

When the dredging was completed, guide-frames for the caissons were erected; and the first section was lowered into place. These caissons were of the same type as those used on the 48-inch line, but were 1 foot less in diameter (9 feet). The total length of each caisson was 49 feet; and the final grade to which they were to be sunk was 49 feet below mean high water. As the material here was all sand, and as there was no possible danger of disturbing any piers or foundations (there being none to disturb), we decided to sink the caissons by pumping below the cutting edge with centrifugal pumps—at the same time loading them with enough pig iron to overcome the skin friction.

Conditions were ideal here for this class of work; and the two caissons were sunk to grade in a total of 148 working hours. The bottom of each was then sealed with a layer of concrete, and the drips lowered in place.

Work was then commenced on driving the steel sheet-piling for the first 120 feet section of coffer-dam. This piling was furnished in 45 feet lengths, and was driven about 3 feet below the pumping grade, which at this point was 45 feet below mean high water. To allow plenty of working room for laying the pipe, the trench was made 18 feet wide. On completion of the coffer-dam, pumping was started—a 12-inch and an 8-inch centrifugal pump handling about 150 cubic yards per day. The material to be pumped was mostly sand, with a little gravel and small boulders, which latter did not prove at all troublesome.

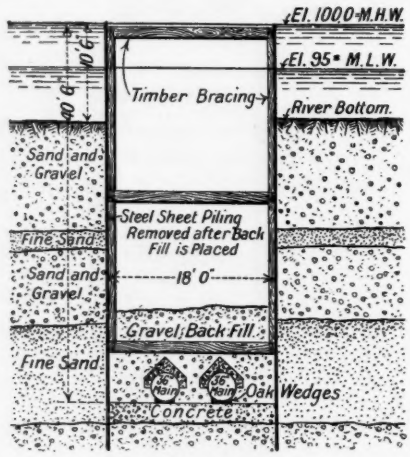


Fig. 9.—Cross Section of the 36 Inch Harlem River Gas-Mains.

There is a four or five mile per hour tide at this point in the river; and it was found necessary to brace with 12-inch by 12-inch timbers, as shown in fig. 9; a set of these braces being placed every 10 feet. There was also a considerable pressure exerted on the sheet piling, due entirely to the weight of the material outside.

As fast as sections of the coffer-dam were pumped to grade the concrete piers were placed, and the pipes set in place. The pipe used on this work was the ordinary water-weight (5200 lbs. per length) hub-and-spigot pipe, with a depth of hub of 5 inches. A ½-inch inside joint, similar to that described for the 48-inch line, was provided for in each length. The pipe was lowered, graded, lined, and caulked in exactly the same manner as the 48-inch line previously described.

Concrete protection blocks similar in shape to those used on the 48-inch line were then placed over the pipe; the trench back-filled with clean gravel to a depth of 4 feet above the top of the blocks; and the sheet piling pulled and driven ahead for the next section of coffer-dam.

While this river work was in progress, work was started on the concrete culvert under the six tracks of the New York Central and Hudson River Railroad. This work was very slow and difficult on account of the frequent passing of trains on the six tracks. We were practically obliged to tunnel the whole distance; and it was necessary to build a coffer-dam at the outshore end to keep out the tide water.

DR. BONE ON GASEOUS COMBUSTION.

Discussion on the British Association's Report.

We have received from Professor W. A. Bone, D.Sc., F.R.S., a print of the report on "Gaseous Combustion" presented by him at the meeting of the British Association in Sheffield last year, accompanied by some notes of the discussion upon it. It will probably be remembered that the report, as revised by Dr. Bone, was given in full in the "JOURNAL" for the 6th of September (p. 648), together with a general indication of the remarks to which it gave rise. As the notes of the discussion now appended to the paper have been compiled by the Secretaries of the two Sections (Physical Science and Chemistry) by whom the report was considered, and, moreover, raise some interesting points which are reported for the first time, we avail ourselves of Dr. Bone's permission to reproduce them, with his written reply.

Sir J. J. THOMSON called attention to the fact that combustion is concerned not only with atoms and molecules, but also with electrons—*i.e.*, bodies of much smaller dimensions, and moving with very high velocities. These may precede the explosion wave, and prepare the way for it by ionizing the gas. But the motion of the ions can be stopped at once by means of a transverse magnetic field, in which they curl up and are caused to revolve in small circles. It would be of very great interest if Professor Dixon's experiments on the photography of the explosion wave could be repeated under such conditions as to determine whether the form of the wave could be modified by such a magnetic field. The positive and negative electrons were of very different dimensions, and when first projected travelled with widely different velocities; but in an ordinary gas these velocities soon become almost identical. It had, however, been shown by the work of Townsend at Oxford and of certain workers on the Continent that in carefully dried gases the velocity of the negative electrons might be 100 times as great as the velocity of the positive electrons. The amount of moisture required to reduce this velocity to its ordinary lower value was exceedingly small comparable with that required to initiate chemical change. It was not unlikely that the two phenomena were very closely related. In reference to the influence of hot surfaces in promoting combustion, to which Professor Bone had drawn attention, it was not improbable that the emission of charged particles from the surface was a factor of primary importance. Hot lime gave out an enormous stream of negative electrons travelling with a high velocity; while hot metals emitted an excess of positive electrons, as indeed Professor Bone had found by the development of a negative charge on the silver foil which he had used as a contact surface. These electrons might produce very important effects by uniting (perhaps selectively) with moisture, with the oxygen, and with the inflammable constituent of the gaseous mixture. The mode of action of the oxides was specially worthy of investigation. Chemists recognized two stages of oxidation in baryta and perhaps in lime. It may be that the problem of the source of the energy of the torrent of electrons might be found in the oxidation and reduction of the contact substance. He suggested that the action of surfaces might ultimately be found to depend on the fact that they form a support for layers of electrified gas in which chemical changes proceed with high velocity.

Sir OLIVER LODGE strongly supported the proposal that experiments should be carried out on the velocity of propagation of explosion waves in a magnetic field. The high velocity of the detonation wave seemed to point to the initiation of some new type of chemical change, such as a burning of carbon following the burning of sulphur in the combustion of carbon bisulphide, or the initiation of a change involving the collision of three instead of two molecules. The velocity of sound which had been referred to as a factor in connection with the explosion wave was not a constant quantity. A bullet, for instance, could not really travel with a velocity greater than that of sound; if it did, the air would be shattered as if by an explosion, and the bullet stopped. This result was in practice prevented by the compression, and consequent heating, of the air in front of the bullet, whereby the velocity of sound was momentarily increased immediately in front of the bullet to perhaps three times its ordinary value, in accordance with the equation $V^2 = kRT$. That very great heating could thus actually occur was shown by the fact that the compression was made use of in the Diesel engine to produce ignition. The rate of explosion must depend a good deal on the amount of exposed surface. While hot surfaces promoted combustion, cool surfaces unfortunately had an opposite effect. This was responsible for the production of vast quantities of soot and smoke, especially in firing steam-boilers; and it also gave rise to trouble in heating and annealing armour-plates. If a surface could be discovered which would promote combustion even at lower temperatures, the discovery would be of very great value. The escape of an electric charge from a contact surface during combustion might very well be purely mechanical; the positively-charged adhering layer being literally scraped away by the force of the flame.

Professor H. B. DIXON, referring to his recent work, said that Nernst had suggested that a gas fired by compression would be heated uniformly, and would therefore detonate as a whole. This was not found to be the case. The gas actually fired in a particular layer, though the explosion began rather indefinitely, and no

well-defined sound waves were propagated from the point of ignition. The explosion of hydrogen and chlorine by light was of special interest, as it did not occur in the well-dried gas. In the moist gas, there was an interval of time before explosion took place, similar to the "pre-flame period" in gases fired by adiabatic compression. But when once the wave was started, whether by a spark or a flame or by light, it proceeded independently of moisture, and indeed was actually most rapid in the dry gas. The explosion was then propagated by molecular collision, and, on account of its high velocity, probably by collisions between pairs of molecules only—a point on which Sir J. Larmor had laid special stress in his Wilde lecture. In the explosion of hydrogen and oxygen, as in that of hydrogen and chlorine, the action started by a spark was propagated as well in the dried as in the undried gas. So far, experiments on the influence of an electric field had given negative results, and the action of Röntgen rays on a mixture of hydrogen and chlorine did not render it more sensitive to light. Supporting the suggestion of Sir J. J. Thomson, he thought it not unlikely that an invisible compression wave might travel just in front of the visible flame; the particles being thereby raised to a high temperature. The brightness of the flame might well be due to the fact that the gas was already very hot before combustion occurred. He proposed to repeat the experiments of exploding gases in a strong magnetic field, and photographing the flame.

Professor SMITHELLS expressed the hope that the report would be carefully read by the members of the Physical Science Section. The matter had now been carried to a point at which the co-operation of physicists was absolutely essential for further advance. Chemists had been compelled to acknowledge their limitations by using meaningless words such as "catalysis" and "contact-action," to conceal their ignorance. The real meaning of these words might be found if the co-operation of physicists could be secured.

Professor ARMSTRONG regretted the absence of the engineers, who were discussing, at a separate gathering, a problem which appeared, from the printed report of their Committee, to be essentially physical in its main features, and almost identical in character with that which the Physical Science and Chemistry Sections were now discussing. He dwelt on the need of an understanding being arrived at by chemists and physicists as to the nature of chemical change. The phenomena could not well be interpreted either from a purely chemical or from a purely physical point of view. At present they could not help one another, because they did not understand one another. The two parties did not seem able to arrive at a common understanding; nor would they do so until each could fully appreciate the point of view taken by the other. Such meetings as that which they were holding were becoming of the utmost consequence to the progress of science in these days of extreme specialization. He had heard with pleasure that, at last, Professor Dixon was prepared to admit that the presence of moisture was at least necessary in starting the wave of explosion in a mixture of hydrogen and chlorine; and he (the speaker) thought that he would ultimately be obliged to admit that it was necessary throughout. If moisture were present initially, and were instrumental in conditioning the explosive wave, it must clearly remain in the wave front and be operative throughout the explosion, even supposing the gas in which the wave was advancing to be dry. An excess of water, however, might well act detrimentally by promoting reversals. It appeared to him to be now established that action could not take place unless a conducting system were formed. This was equally true of ordinary cases of chemical change and of the passage of an electric discharge through gases. One member of the system must be an electrolyte. [Sir J. J. THOMSON here interposed the remark: "What is an electrolyte?" and appeared to imply that any substance would behave as an electrolyte if only a sufficient electromotive force were applied.] Professor Armstrong then dwelt on the very great importance, from this point of view, of Sir James Dewar's observation that the atmosphere of a bulb containing helium could be so far purified by means of charcoal cooled by liquid hydrogen that it was impossible to pass an electrical discharge across the bulb, even when a high potential was used, though the vanes of a Crookes radiometer mounted within it rotated merrily when a heat source was presented to the bulb. He insisted on this observation as proof that conductivity was conditioned not by the mere presence of a gas, but of a gas in association with the necessary impurity (conducting moisture) to render possible the formation of conducting systems within the tube. Proceeding, he said: The argument is probably one of great importance in connection with the assumption that electrons exist as distinct entities. The substances which are supposed to give off electrons when heated are all substances that are more or less easily dissociated; and the experiments made with such substances have not been carried out with the scrupulous care to remove "impurities" which the observations made by Brereton Baker and Dewar have shown to be necessary. There is nothing at present to prove that "electrons" are given off otherwise than in cases in which an ordinary discharge will pass. Moreover, the argument on which the determination of the size of negative electrons is based is in no sense one which serves to place their existence beyond question. It is now admitted by prominent physicists that molecules can carry charges—those of helium, for example; so that it is not even necessary to assume the existence of dissociated charged ions as carriers of electricity. The admission is of some importance, as in the early days of the discussion on electrolysis the contention that molecules and aggregates of molecules might act as carriers was scorned. Compare "The Conditions Determinative of Chemical Change and of Electrical Conduction in Gases and on the Phenomenon of Luminosity."*

Professor BONE, writing in reply, expressed the hope that the discussion would lead to a more active co-operation between physicists and chemists in the further investigation and interpretation of gaseous combustion. Proceeding, he said: If it be admitted (1) that the forces holding the atoms of a molecule together are electrical in character, and (2) that the unit of electricity is corpuscular, and capable of independent movement outside the boundary of the chemical molecule, it seems probable that such corpuscular electric units ("electrons") play some part in gaseous combustion. The utility of the "electron" theory to chemists, however, will largely depend upon its ability to interpret some of the more obscure factors in combustion dealt with in the report. With regard to the subject of "surface combustion," recent experiments carried out by Mr. H. Hartley and myself (the details of which will be published shortly) have proved that certain ordinarily non-oxidizable metals (silver, gold, &c.) become negatively charged when heated at 200° to 400° in either hydrogen or carbon monoxide, and positively charged on being similarly heated in oxygen. These surfaces also become negatively charged during the catalytic combustion either of hydrogen or of carbon monoxide, though there is so far no evidence that the main body of the gas outside of the catalyzing surface becomes "ionized" to any appreciable extent. If the + or − charging of the surface really implies the escape therefrom of − or + "electrons" respectively with velocities insufficient either to ionize the gas outside, or even to allow of their travelling far from the surface (so that they would be likely to remain within range of the attraction of the layer of opposite sign on the surface), it seems at least conceivable that such slowly-moving electrons may attach themselves to, or condense around them, the molecules of combustible gas or of oxygen, which, thus charged, would be attracted to the surface. Some such view, if admissible from the standpoint of the physicists, would seem capable of explaining certain of the phenomena of surface combustion, as, for example, the quite abnormal retarding influence of moisture referred to in the report. But before any such idea can be confidently adopted as a working hypothesis by chemists, it will be necessary for physicists to define more clearly than they have done hitherto the function and significance of the supposed "electrons" in chemical interchanges. From the chemists' standpoint, a clear statement of the physicists' views in relation to these matters is urgently needed, and, if forthcoming, would considerably enlarge the field of immediate experimental inquiry.

* *Vide* Roy. Soc. Proc., 1902, pp. 72, 99.

The Midland Junior Gas Engineering Association will visit the Adderley Street works of the Birmingham Gas Department next Friday evening, when they will be entertained at tea.

Sulphur Compounds and Gas-Engine Oils.—In the course of a discussion, at a meeting of the Chemical Society in Manchester, on some of the troubles experienced with lubricating oils, an interesting point was brought out in connection with gas-engines. It was stated that sulphur compounds in the gas react upon the lubricating oil in the cylinder to produce a solid or semi-solid sulphur compound, which interferes with the satisfactory working of the engine. Apparently, what is known as carbonized oil in cylinders is frequently not burnt oil at all, but a sulphur compound with oil; and the opinion was expressed that the remedy would lie not so much in the use of another class of oil as in the better purification of the gas.

Ozone for Water Purification.—Reference has been made at various times in the "JOURNAL" to the system of purifying water by means of ozone. We have received from Ozonair Limited, of No. 96, Victoria Street, Westminster, who are patentees and manufacturers of apparatus for the commercial production of ozone for all purposes, an advance copy of a circular giving illustrated particulars of the method of applying the system to water purification. It is claimed that ozone is the ideal agent for this purpose, inasmuch as, after proper treatment, water will be in perfect condition for human consumption, no matter how highly charged with dangerous organisms it might previously have been. Not only will it have been rendered harmless, but it will have a sparkling brightness which before was absent.

Scottish Junior Gas Association (Eastern District).—Between forty and fifty members of the Eastern District of the Scottish Junior Gas Association paid a visit on Saturday afternoon to Bowhill Colliery, at Cardenden, belonging to the Fife Coal Company, Limited. They were received by Mr. Wilkie, the General Manager, and were by him and his assistants shown the pithead equipments, and the workshops. There are two pits at Bowhill—one 220 fathoms and the other 200 fathoms in depth. The yield is chiefly splint—including the Dunfermline splint. The visitors were taken down one of the pits, and were conveyed underground in trucks provided for the workmen to travel in, along electrically lighted roadways, to the working places. The colliery has the reputation of being one of the best equipped in the United Kingdom. On returning to the surface, the visitors were entertained by the Company to tea. The President (Mr. W. Dunlop, of Kirkcaldy) proposed a vote of thanks to the Company; and the Vice-President (Mr. J. R. Moyes), one to the officials and staff.

THE HYGIENIC ASPECT OF GAS.

Birmingham and Smoke Abatement.

At a meeting of the Midland Association of Local Government Officers, held in Birmingham on Monday evening of last week, a paper was read by Mr. R. J. Rogers, the Lighting Superintendent of the Birmingham Gas Department, on the "Use of Gas in Relation to Public Health, with Special Reference to Smoke Abatement." The paper was extensively illustrated by lantern slides, and by the exhibition of charts emphasizing by the statistics displayed various important points to which more special attention was drawn by the author. Having regard to the character of the audience—comprising as it did so many branches of municipal service—the paper was necessarily of a non-technical description. The plea that ran through the address was that a Birmingham branch of the Smoke Abatement League might be inaugurated, similar to those already formed in Glasgow, Sheffield, and other large centres; and although no definite steps to this end were decided upon at the meeting, it is to be hoped the matter may not be allowed to drop. In an industrial city like Birmingham, the work of such a Society should be of invaluable benefit to the community.

Dealing with the hygienic aspect of gas lighting, the author remarked that the advocates of electric light contended that electricity was far superior to gas, because, they stated, the former did not consume or vitiate the air, while gas did so, and that electricity did not create heat nor damage decorations. In controverting this opinion, Mr. Rogers quoted the results of impartial investigations made by prominent scientific authorities, who, as he pointed out, had no more bias towards gas than towards electricity. Of particular interest were the results of exhaustive experiments carried out in Birmingham by Professor Percy Frankland, F.R.S., of the Birmingham University in 1902, on behalf of the Museum and School of Art Committee, with the object of ascertaining whether the artificial illumination of the large room in the Municipal Art Gallery by electric arc lamps or by incandescent gas installations was preferable, from the point of view of possible damage to the pictures exhibited there. Briefly summarized, the results of his experiments were as follows:—

(*a*) In the absence of any artificial illumination, there was a slight increase in the percentage of carbonic acid in the air of the gallery in the course of the day.

(*b*) With the arc lamp illumination, the increase in the percentage of carbonic acid was distinctly more marked.

(*c*) With the incandescent gas illumination, instead of there being any increase, there was a distinct diminution in the percentage of carbonic acid in the air.

In his report, Professor Frankland stated: "The explanation of this diminution is not far to seek; it being obviously due to the more efficient ventilation of the gallery, which is caused by the great draught of heated air through the shafts which are placed above the incandescent burners. The circumstance that the percentage of carbonic acid actually diminishes during the use of the incandescent gas-burners conclusively proves that the products of combustion from which damage to the pictures might be apprehended are completely carried away by the ventilation which is so much promoted by these burners." The Professor concluded his report by saying: "In my opinion, therefore, the incandescent gas installation at present provided in the Art Gallery is to be preferred to the arc lamps, which are much less effective in promoting ventilation; and though these lamps do not give rise to sulphur compounds, they do generate ozone and oxides of nitrogen, which are calculated to act prejudicially on pictures." Mr. Rogers subsequently quoted the remarks of Professor Vivian B. Lewes in this connection made in Dublin, which were in complete confirmation of the conclusions of Professor Frankland.

The ill-effect on the eyesight of the brilliant electric lamp was strongly emphasized by the author. It was, he stated, conclusively proved that clear glass electric lamps should be so placed, shaded, or obscured that no rays from the filament would strike the eye at any angle. This was a point which should be borne in mind when estimating the cost of electric lighting, as the cost of obtaining a given amount of light when screened or diffused would be double, as compared with the cost of using clear globes. Too much importance could not be attached to the question of sight injury from the use of clear electric lamps.

Dealing particularly with the question of smoke abatement, Mr. Rogers briefly sketched the results already achieved by the Smoke Abatement League. Broadly speaking, the cause of smoke was the unscientific methods adopted for the combustion of coal. The factory owner required to be educated and advice given as to how the emission of smoke might be prevented with advantage to himself and his neighbours. The domestic fire was in a great degree responsible for the pollution of the atmosphere and for the smoke clouds over our great cities and towns; the most expert opinion on the point placing the proportion so due at between 50 and 70 per cent. of the total smoke emitted—the proportion, of course, varying according to the industrial character of the town under observation. Burning coal even under the best conditions, at least ½ per cent. in factories and 5 per cent. in domestic grates passed away in the chimneys.

The smoke nuisance had now assumed the dimensions of a great sanitary, social, and economic problem. Many attempts had been made to determine the annual cost which its pall of black smoke imposed upon London. The Hon. R. Russell, F.R.M.S., in his well-known treatise "London Fog and Smoke," after careful consideration, put down the cost at no less than £5,470,000 each year. This enormous figure might at first sight appear to be excessive; but when one considered the various headings under which such an estimate had to be made, it would be agreed that the figure (which, moreover, was calculated many years ago, when there were a less number of houses and factories in London than at present) was not too high. It was interesting to note the miscellaneous character of the headings included in the calculation, and the varied interests affected by the smoke fiend—namely, waste of fuel; extra washing and wear and tear of linen; dresses, carpets, blinds, and other textile fabrics damaged and renewed; increased mortality (valued on its economic side only); impairment of health; illness, and consequent expenses; reduced strength; hindered convalescence; lower vitality and working capacity; slow destruction of stonework, granite, marble, &c., on public buildings, and cost of cleaning exteriors; destruction of mortar, cement, &c., making rejointing necessary; painting of houses inside and out; restoring gilding, metal work, shopfronts, signs, names of streets, and advertisements; restoring monuments, &c.; window cleaning, including station roofs; replacement of blackened wall paper, &c.; depreciation of works of art, pictures, books, engravings, &c., in public and private collections; loss of time by artists, photographers, and other workers requiring daylight; extra labour owing to tarnishing of silver, &c.; damage to trees, plants, flowers, vegetables, and fruit; loss of time by delay of trains; accidents of all sorts; cost of fog-signals; supervision of river traffic; extra gas, candles, and lamps, both in dark fogs and in shortened morning and evening light throughout the year; extra fuel burnt owing to want of sunshine and loss of warmth; cost of chimney sweeping, &c.; depreciation of house property. He would like them to remember that smoke cost nearly as much as the fuel. For every £1 spent in raw coal by the householder, an expenditure of another £1 was involved to make good the damage done by the combustion of the fuel.

As regards the effect on stone-work, he reminded them of the evidences in Birmingham on the municipal buildings, and various churches, chapels, and other buildings, many of which were being seriously eaten away. The effect on health was a most important point; and he displayed charts showing the records of sunshine in different parts of the country and the annual average for the four years 1905-1908 in various seaside, residential, and manufacturing towns—pointing out that from these figures Birmingham received only 29 per cent. of the sunshine which was astronomically possible.

As to how soon the smoke evil was likely to be appreciably diminished, this would depend on the rate of progress made in the education of fuel users, and also the means to hand for providing heat cheaply, conveniently, and cleanly—such as the cost of gas and the invention and cost of other smokeless fuels. Much good had already been accomplished; and a writer in "The Times" of the 27th ult. stated that there had been a gradual reduction in the number of days of fog each year in London, which he attributed in large measure to more vigorous enforcement of the smoke-prevention clauses of the Public Health Act, but remarked that it had in all probability been materially aided by the increased use of gas-fires for both heating and cooking purposes, and also by improved methods of lighting. The adoption of gas-fires for the domestic grate would help considerably in obtaining a purer atmosphere. The use of high-pressure gas for industrial purposes would also materially assist in the reduction of the smoke nuisance; and the author drew attention to the efforts now being put forth by the Birmingham Gas Department in developing this side of their business.

The question of town planning schemes is now engaging the attention of many local authorities; and Mr. Rogers emphasized the importance of adequate provision being made in all houses erected under such schemes for the use of gas for the heating of water, for gas-fires, and for cooking purposes. The chief object of the town-planning schemes was the provision of healthy homes and cheerful surroundings for the people; and surely they had such evidence of the serious deleterious effects of the smoky atmosphere on the healthy surroundings of existing cities and towns, that the importance of preventing the evil should be made apparent to the promoters of all town-planning schemes.

A vote of thanks to the author was proposed by the Chairman (Mr. Negus, of Castle Bromwich), and seconded by Mr. Crump. Among the supporters of the resolution was Mr. Foulds, the newly-appointed Secretary of the Birmingham Electric Lighting Department, who remarked that, though Mr. Rogers and himself were friendly rivals, and there were statements in the paper with which he could not agree, they were servants of the same Corporation, and were both striving to reduce the smoke nuisance in the city of Birmingham. Mr. Rogers responded to the resolution, replying at the same time to various points raised by the speakers. He emphasized the desirability of following the lead of other cities, and forming a branch of the Smoke Abatement League.

At a recent meeting of the Junior Institution of Engineers, Mr. W. T. Hogg, the Assistant-Manager of the Mitcham and Wimbledon Gas Company, gave a lecture on "Gas Manufacture," illustrated by lantern slides, photographs, models, &c., lent by West's Gas Improvement Company, Messrs. Cutler and Sons, Messrs. C. & W. Walker, and the Bryan Donkin Company.

YORKSHIRE JUNIOR GAS ASSOCIATION.

An Address on Pressure.

The first Meeting of the Association in the New Year brought together a large assembly of members at the Bradford Technical College last Saturday.

In opening the proceedings, the PRESIDENT (Mr. F. Scholefield) reminded the members of the courses of lectures on various branches of gas supply and consumption which are being delivered at the Leeds University, and mentioned the various ways in which the Council of the Association had endeavoured to render the advantages of these courses available for the members. As it had proved impossible to arrange the lectures for any other times than Wednesday evenings and Thursday mornings, an effort had been made to enlist the assistance of the gas authorities in Yorkshire by reinforcing the University's own appeal to them, and soliciting favourable consideration of any requests from would-be students for leave of absence on each of the Thursday mornings involved. He was glad to inform the meeting of some very kindly assents to these requests, and trusted finally to hear of many recognitions of the value of University facilities both on the part of the members and of their engineers and employers. With respect to their proceedings that afternoon, there was no need of any introduction of the speaker, inasmuch as Mr. Cranfield's work in connection with the Association had made him known and valued by all; while his many years' experience of students and juniors generally had enabled him to find out just the points most necessary to touch upon in the important subject he had announced for the meeting.

Mr. CRANFIELD then proceeded to deliver his address, a synopsis of which had been prepared and placed in the hands of all present—a departure from the usual practice which proved very welcome, and materially assisted in the following of its many points.

SOME ASPECTS OF PRESSURE.

A volume of any gas consists of a number of infinitely small molecules, which do not, however, completely fill up the space; being separated from one another by intervals which, though almost inconceivably small, are yet enormously greater than the diameters of the particles themselves. Consequently, a room is not filled with air particles in the same sense that it could be filled up solid with bricks orderly arranged; so far, in fact, is this from being the case, that in many scientific calculations the space occupied by the particles themselves is ignored. These gaseous particles are supposed to be in a state of violent motion, darting at a great rate and in all directions, though the actual distances travelled in a straight line are but small, owing to their coming into contact with other particles and then rebounding in fresh directions. The mean rate of hydrogen particles (the fastest moving) is calculated to be 1·15 miles per second. The pressure a gas exerts on the sides of the vessel containing it is really the result of all these bombardments of moving particles; and if the gas is compressed into less room the pressure is increased, because there will then be more gaseous particles in a given space, and, consequently, more particles bombarding a given area of the sides of the vessel.

AN "UNFORTUNATE" TERM.

This constant movement tends to prevent a mixture of gases forming layers according to their densities, with the heavier at the bottom and the lighter ones at the top. It also secures the intermixture of gases known as diffusion, by which the composition of a volume of mixed gases tends to uniformity—*e.g.*, the atmosphere at all levels, gas in a holder, &c. In discussing unexpected and unwelcome results sometimes found in the quality of gas that has been standing for some time undisturbed in a holder, the word "stratification" has unfortunately been used; and, still more unfortunately, omitting to consider all the facts of the situation, some have been led by the term to imagine some degree at least of separation of the gaseous constituents according to their densities. The explanation is rather to be found in the results of temperature changes—viz., the condensation of illuminating hydrocarbon vapours by the chilling action of the holder sheets and the water surface, and the increased solubility of some of the illuminants in the colder water—the action assisted by prolonged and undisturbed contact of water with the coldest layer of the gas. But the word ought not to be used of any mass, unless it manifests distinctly recognizable layers right through its mass. Of course, a kind of temperature stratification exists in the atmosphere—the temperature falling fairly regularly as we ascend; and some such state of affairs may be found in a full holder of large area, especially when the air has risen considerably in temperature after a long period of severe cold, from which the great mass of water in the tank with its high specific heat would be some time in recovering. Still the word "stratification" is unfortunate; and its use is to be deprecated in this connection.

CONDENSATION AND VOLUME.

In the case of liquids and solids, the particles are very much nearer together, as well as many more atoms combined into a molecule. Consequently, whenever a gas is liquefied or solidified, a great diminution of volume ensues—*e.g.*, steam condenses to 1/1700th of its volume; a cubic foot of steam yielding about 1 cubic inch of water. This is important from the point of view of unaccounted-for gas—condensed products in the distributing mains meaning much loss of gas volume. Mr. Walter Hole calculates that, in Leeds, this represents more than 42 million cubic feet per annum. All the trouble our distribution departments have with naphthalene arises from the fact that when it is allowed slowly to condense out of the gas, its crystals do not lie as closely together as those of other bodies, but form a bulky, light mass, occupying 400 times the space of an equal weight of snow and 4000 times that of an equal weight of ice.

Every known gas has now been liquefied or solidified—in most cases by extreme cold, in a few cases by pressure only; while pressure alone would suffice in every case if the gas were first lowered to, and kept at, a certain temperature (different for different gases), known as its "critical temperature."

GASES AND PRESSURE.

The word "pressure" is used rather loosely, and in two senses. First, for the weight on a given area of the gas that reduces its volume; and, secondly, for the outward force which the gas exerts on the vessel containing it. This latter is really the sense in which the word is used in gas practice, and is the more correct use of it. Of course, the two uses of the word are connected, inasmuch as a gas in a non-rigid container, or in one free to expand and contract in at least one direction—*e.g.*, a gasholder—may be looked upon as being in a state of equilibrium, having expanded or contracted till its outward pressing force is just equal to the opposing force pressing upon it. Gases differ from solids and liquids in exerting their pressure in all directions; so that a gas under all circumstances fills the vessel into which it is put, whatever the size of the vessel and the original volume of gas introduced.

THE KINETIC THEORY.

The kinetic theory of gases gives us at once an explanation of Boyle's law, by which we correct our volumes of gas for varying pressures. By compressing a gas to one-half its volume, we are forcing twice as many gaseous particles into a given space, and doubling the number of impacts of particles against the containing walls—*i.e.*, doubling pressure. Similarly, with other degrees of compression, volume and pressure vary inversely as one another.

The kinetic theory enables us readily to explain the expansion of gases by heat and to see that it is really a manifestation of pressure. A rise in temperature means an increased velocity of the moving gaseous particles and, consequently, a greater momentum when they strike anything—*i.e.*, a greater pressure. This is readily seen when a gas is heated under conditions that preclude or retard expansion—*e.g.*, in steam-boilers. Steam at 100° C. has, then, an absolute pressure of 15 lbs. to the square inch. At 121·1° this rises to 30 lbs., at 134·4° C. to 45 lbs., at 144·4° to 60 lbs., at 152·7° to 75 lbs., and so on. If free to expand—*e.g.*, when confined over water, as in a gasholder—the increased momentum of the heated gaseous particles either forces back the liquid or raises the vessel, so allowing the gas to expand until a new equilibrium has been established, when the increased momentum of the particles just compensates for the lesser number of impacts due to the lessened number of particles in a given space.

The accumulated weight of the air from the earth's surface to the utmost extremity of the atmosphere (wherever that may be) causes what we know as the atmospheric pressure. If a glass tube about 3 feet long is filled with mercury and inverted in a dish of mercury, the liquid sinks a little way down the inverted tube, remaining at a height of about 30 inches above the level of the outside mercury. The column is upheld by the atmospheric pressure on the surface of the mercury. Let us think of a thin layer of mercury in the tube on the same level as the surface of the outside mercury. Pressing down upon it is the weight of the 30-inch column of mercury, and pressing up against it is the transmitted amount of the atmospheric pressure on a surface equal to the cross section of the tube; and these are equal. This layer of mercury that we have been imagining may be regarded as the beam of a balance; and it will rise or fall according as the atmospheric pressure either increases or decreases. We generally measure the atmospheric pressure by the height of this column; and it is commonly about 30 inches, or 760 millimetres. If water were used, the atmospheric pressure would sustain a column of about 34 feet or 408 inches (as mercury is about 13½ times as heavy as water). The weight of this column of water is, of course, equal to that of a 30-inch column of mercury in a tube of equal bore; and if the tubes had a cross section of 1 square inch, each would weigh 15 lbs. So that we may also express the standard atmospheric pressure as being 15 lbs. to the square inch. Many calculations as to pressure (air and steam blasts in a carburetted water gas plant, high-pressure distribution, &c.) are facilitated by remembering that a pressure of 1 atmosphere = 30 inches of mercury = 408 inches of water = 15 lbs. to the square inch.

In all ordinary cases, our gas pressures are given in terms of inches of water column, and always expressed as so much in excess of the atmospheric pressure. So that 2-inch gas pressure is really about 410 inches absolute pressure; while 0-inch on a gauge means atmospheric pressure, just as zero on a steam-gauge means one atmosphere pressure of 15 lbs. to the square inch, while 15 lbs. would represent two atmospheres pressure. In expressing gas pressures—say, on a purifier lid—and calculating the opposing forces, the downward force of air pressure on the lid must not be included unless absolute pressure was allowed for in the gas. In applying Boyle's law to correct gas volumes for changes in pressure, it is, however, absolute pressures that have to be taken—*e.g.*, in high-pressure distribution, a change from 2 lbs. to 4 lbs. pressure must not be regarded as doubling the pressure (at least, if this expression is used it must not be imagined as halving the volume), still

less must we so regard a change from 2-inch to 4-inch pressure. In the one case, it will mean a change from 17 lbs. to 19 lbs. absolute pressure, and a change to $\frac{17}{19}$ of the former volume; while the change of volume in the latter instance will be but to $\frac{14}{14\frac{1}{2}}$ of the original volume. Boyle's law holds good for calculations in whatever terms the absolute pressures are expressed.

ATMOSPHERIC PRESSURE INFLUENCES.

As air pressure is caused by the weight of a column of air, it follows that, as we rise to higher levels, there is a decrease in the weight of air above us, and, consequently, in the air pressure or height of the barometer—*e.g.*, a difference of $\frac{1}{2}$ inch of mercury, or nearly 7 inches of water, is always found between two points very near together on the Halifax Ordnance maps, one at the base and the other at the crest of a very steep hill. This difference of atmospheric pressure is equal to about 1-10th inch water column for each 10 feet of vertical rise; and as what we call our gas pressure is the excess of the real gas pressure over atmospheric pressure, gas pressure appears to increase in the distribution system 1-10th inch for each 10 feet vertical rise. Practically the same difference would be found if we were distributing air or a heavy gas through the pipes. It is important to remember this explanation, as many think the rise in apparent pressure is due to the light gas tending to rise along the pipes. This is an entirely wrong idea, as, though coal gas can rise through air, there would be nothing to induce it to rise in a system of pipes containing only coal gas. Though everyone is familiar with the tendency to higher pressures in the top storey of a house or a mill, the increase is not as a rule 1-10th inch per 10 feet, owing to the friction in the service-pipes, especially if smaller sizes are put in for the upper floors.

PRESSURE IN THE DISTRIBUTION SYSTEM.

Setting aside this influence of increasing elevation, the sole cause of gas pressure in the distribution system is the weight of the holder—*i.e.*, the primary cause is *behind* the gas flow. Any hindrance to this flow—friction along the pipes, obstructions, &c.—will cause a rise in pressure in the gas approaching the obstruction, &c. (which rise will gradually be transmitted to the station governor and be cut-off, in part at least), and a fall in pressure in the gas that has passed the obstruction. The more serious the obstruction, the greater this fall. On the works, pressure is caused by the resistance to the gas due to the weight of the holder to be lifted, to the effort needed to force a way through the close-lying purifying material, to the water which has to be pushed through in the washers, &c. All these throw a pressure which increases as we recede from the holder—*i.e.*, unlike the district pressure, the cause of works pressure is *before* the gas flow. As, then, in the district the pressure at the end of the gas flow is what counts, and on the works that at the beginning of the gas flow is what we have carefully to watch and keep down, we get the apparently contradictory statements that friction increases pressure on the works, but decreases it in the district.

For the ready grasping of the many problems in connection with pressure, it is most important to translate (mentally at least) pressures into volumes—*e.g.*, different pressures have to be given at the station governor at various times of the day. Really the consumer does not want different pressures. The ideal is a constant unchanging pressure at the point of consumption; and with present-day developments in the purposes and conditions of gas using, increasing attention will have to be paid to secure by some means for consumers a nearer approximation to proper and consistent conditions, as varying pressure will mean varying degrees of efficiency in gas-using appliances. When the extra pressure has to be put on at the station governor during certain hours, it is really only in order to deliver a greater volume than before through the same pipes in a given time. This can only be done by increasing the initial driving force—*i.e.*, letting a greater proportion of the holder weight fall on the gas issuing to the district; and this will result in a greater speed of gas flow and in the gaseous particles being forced closer together, resulting, as we have already seen, in greater gas pressure. The increased initial pressure is thus the sign and result of our modified practice, and not in itself the end-all and be-all of our action.

Within certain limits, a station governor will keep pressures fairly constant, notwithstanding changes of holder pressure and changes in the demands of the district. Its valve diminishes the gas-way; and the outlet gas admitted under the bell increases or decreases the gas-way, as the variations in the pressure of the gas affect the buoyancy of the bell. An increase in the demand for gas means at first a drop in pressure, because gas is passing out of the pipes faster than it is coming through the governor. But the gas left must expand and keep the pipes full; so the particles get a farther average distance apart, and pressure falls until the consequent fall in the governor lets through enough gas to restore the governor conditions. Conversely, a slackening of demand leads at first to the gaseous particles getting crowded closer together for a time, beginning at the points of lessened demand and gradually backing-up to the governor, which it then raises, diminishes the volume of gas passing, and so corrects the situation.

Keeping in mind the relation between volume, pressure, and distance apart of the gaseous particles, enables one to realise the problem of keeping an adequate and even supply of gas over an area fed by several centres whose mains are linked-up. Care has to be taken to avoid the accumulation of excessive pressure at certain points. This is nothing to do with differences of elevation, but simply means that the increased supply provided to meet an anticipated greater demand has been given in excessive amount or from the wrong distributing station, and friction in the pipes is hindering the rapid transmission of gas from an area of high pressure to one of low pressure. The fact that an excess in the supply, especially if caused by a drop in consumption, shows itself in pressure rising first at the points of consumption and then backing up to the governor, goes far to account for a common, if unexpressed, idea that pressure is a mysterious something with a distinct existence of its own apart from gas, and possessed of the power of swimming against the stream in the gas-mains.

ON THE WORKS.

On the works, as in the district, the question of pressure is of vital concern; and here, too, it will often be found advantageous to translate pressure into terms of volume. Providing lutes and seals are adequate, the amount of pressure on the gas does not matter very much, except in the retort, and, consequently, in the hydraulic main. The three crucial points in carbonization are high temperatures, satisfactory fire-clay materials, and the avoidance, as far as practicable, of hydrocarbon degradation—*i.e.*, the decomposition of hydrocarbons by heat, with the formation of simpler ones of less illuminating and calorific value, and, finally, the liberation of free carbon and hydrogen. The last-mentioned, which is one of the chief aims in all modern variations of carbonization methods and structural arrangements, is intimately connected with the question of pressure. The ill-effects of pressure in the retort are two-fold. First, the loss of gas through cracks in the retorts; and, secondly, this degradation of hydrocarbons, with consequent loss of calorific and illuminating power, formation of scurf, stopped ascension pipes, pitched mains, &c., without mentioning increased naphthalene formation.

EFFECT IN CARBONIZATION.

Back-pressure acts prejudicially through the following sequence. Pressure means compression of gas—*i.e.*, a greater volume of gas, or so many more gaseous particles, kept in the retort at once. This involves each particle staying a longer time in the heated retort, and therefore reaching a higher temperature, consequently more decomposition of hydrocarbon molecules. In addition to longer exposure to radiant heat, the greater number of gaseous particles in the retort means a greater number actually coming into contact with the heated walls, and losing a great proportion of the hydrocarbons among them. In our desire nowadays to get a good make of fairly low-grade gas of good calorific value, the all-important point is to make and keep in our gas as high a percentage of methane as possible, owing to the fact that, while its illuminating value is only about the same as that of hydrogen and carbon monoxide, its calorific value is three times as high. Methane is the only hydrocarbon known to decompose directly into carbon and hydrogen; and there are not wanting other indications which point to its being the chief source of retort carbon. It remains fairly stable at temperatures that decompose other hydrocarbons; and at temperatures when it does decompose, the rapid increase of the decomposition is apparently more a matter of hot surface contact than of mere temperature. Scurf deposits chiefly occur at just those places where gas would be detained somewhat in contact with the hot walls.

A word in passing: Young students must avoid supposing that the gas emerging from the retort is at the same temperature as the retort—a too prevalent idea, for which the loose language of some writers on gas matters is not without responsibility.

It is also well to express our ideas of the purpose and work of the exhauster in terms of pressure. A common way of expressing it is to say that the exhauster draws the gas out of the retorts and drives it through the rest of the plant into the holder; and even more colloquially we speak of the exhauster drawing the gas from the coal. Such phrases are at least open to the charge of "terminological inexactitude." The gas leaves the retort and forces its way to the holder because it is being liberated in a system already full of gas; and it takes the path of least resistance in pushing the previous gas out of the way. It will do this if no exhauster is in use. What the exhauster does is to relieve the pressure on the gas in the retort—to take, as it were, some of the work of the gas on its shoulders, or to change the figure, it clears the way and lets the newly-made gas have a free course out from the retorts.

It is worth while to reflect how the gas in the retort comes to show pressure. We speak of the holder, purifier, &c., throwing so much pressure; and we shall rightly continue to use such convenient and expressive phrases. But it will be well for us also to think of it in connection with the kinetic theory of gases which we have been considering and applying. The gaseous particles have to stop in the retort, crowding closer together, getting a higher velocity of individual motion as they get hotter, and so raising the pressure till this is able to overcome the resistance to the gas passage. Thus gas pressure in the retort may not only be thought of as something thrown upon the gas from outside, but also, and better, as a force the gas itself develops before it can accomplish certain work.

Wherever we have a mass of liquid partly divided so that it has two surfaces (one open to the air and the other to gas), we have a gauge; and the difference in the heights of the two surfaces gives us the pressure or pull on the gas. Instances of this abound all over a gas-works—*e.g.*, the holder tank and cups, purifier lutes, seal pots, governor tanks, &c.—and it will be well for us to cultivate the habit of mentally seeing the level of the water on the gas side wherever we pass them. Mr. Newbigging's famous advice to gas

engineers to project themselves into a retort and see what was going on there, may receive as a now all-important addition—"Mentally see a section of your dip-pipe and hydraulic main every time a retort is opened." The dip-pipe open to air pressure, and the surrounding liquid in the main, form a gauge, and the most important gauge on the works if only we could clearly see it and accurately read it. If the pipe is sealed in liquor and not in tar, and if the ascension and dip pipes are free from obstruction, the total height that the liquor rises up the open dip-pipe is the measure of what the pressure would be on the gas in the retort if it were closed and making gas. That is, the calculated gas pressure on a retort is the amount of the dip *plus* the hydraulic main gas pressure or *minus* its gas pull. To this must be added an unknown and varying amount representing friction and obstruction in the ascension and dip pipes, and something more if the dip pipe enters the tar layer.

The exact pressure can be found by fitting a temporary lid with a pressure-gauge attached to it. It has occasionally given a startling revelation of unsuspected conditions when it has been used; and such a simple and easily-applied arrangement might well be more commonly kept in readiness. Among other things, it would reveal what great and rapid alternations of retort pressure are caused by what is commonly and succinctly called "hydraulic main oscillation." The rush of the gas in huge bubbles from all the dip-pipes keeps the surface of the liquid broken into waves, by no means small. When a wave rises round a dip-pipe, pressure in the retort rises by an equal amount, and when the trough of a wave surrounds the pipe, there is a corresponding drop in the pressure. Enough has already been said to show the deleterious effect on the quantity and quality of the gas of these repeated accessions of pressure. This oscillation has sometimes been viewed through a window placed in a convenient part of the hydraulic main; and the truth is driven home upon the watchers with convincing force. In the face of this, too fine distinctions as to amount of seal are obviously out-of-place. The use of a retort-house governor may give a very steady gauge on the hydraulic main, but will have no effect on this disturbing influence on the retort-gauge. A lack of clearness is often noticeable in stating the amount of seal—*i.e.*, as to whether the seal referred to is the seal on the dip-pipe or the seal on the gas in the retort, which is very much more important. A dip-pipe may be sealed, and yet the pull of the exhauster may overcome the seal and the retort be unsealed, giving all the disadvantages of a seal and none of its advantages.

PRESSURE IN WASHING.

Pressure is beneficial for washing plant; and there we find the maximum works pressure. Provided the seals are adequate, the higher the pressure the better, as the solubility of a gas in water is increased in direct proportion to the absolute pressure, which is an important consideration when we are dealing with so soluble a gas as ammonia. Then, having first absorbed more ammonia, the alkaline liquid can absorb equivalent additional amounts of the acid gases. It is, of course, comparatively easy to wash gas clean from ammonia; but the desirable end is to accomplish it with a minimum of water contact, and pressure on the gas in the washing plant assists in securing this.

HOLDER PRESSURE.

One or two points in connection with holder pressure may be just looked at. Think for the present not of a vessel surrounding and confining the gas, but of a column of gas supporting a hollow inverted vessel. The weight of this compresses the gas somewhat, and causes what we call holder pressure. If its weight in pounds is divided by the square feet of its sectional area, we obtain the pressure in pounds per square foot. As we commonly, however, express it in inches of water, we can obtain this by dividing the pressure in pounds per square foot by 5·21 (the weight of a layer of water standing an inch high over a square foot). Looked at in another way, when we say that a holder throws 6 inches of pressure, we mean that it weighs as much as a layer of water would if 6 inches deep on the flat crown to a holder. Seeing that a 10-inch layer of snow melts down to 1-inch layer of water, we can at once then estimate what extra pressure any downfall of snow will throw on a particular holder if we know its average depth; and what weight of snow is actually resting on the holder if we know either the depth of snow or the extra pressure occasioned. The weights put on a governor bell to give extra pressures can be similarly calculated; each inch needing a weight equal to a layer of water 1 inch deep on the crown. The reasons why holders of greatly differing size and weight may throw the same pressure, and why different holders of the same capacity (and approximately equal weights) may yet throw greatly differing pressures, are obvious, seeing that the pressure may be calculated by dividing the weight by the area. So the greater the diameter is compared with the height, the less the pressure.

HIGH-PRESSURE LIGHTING.

One final consideration out of many others that arise in studying pressure. What part does pressure play in high-pressure lighting, and how is the additional illuminating value per cubic foot of gas obtained? Here a conversion of pressure into volumes does not completely answer the question or help us as much as in some of our previous inquiries. Although there is, of course, a greater consumption of gas and a larger mantle, that does not explain all, and particularly does not account for the greater economy, for the higher value obtained per cubic foot. The all-important factor in incandescent lighting is flame temperature; and this is determined partly by the calorific value of the gas and partly by the size of flame produced by a given rate of consumption—the smaller the area over which a given amount of heat is developed, the higher the temperature attained. The size of flame for a given consumption depends partly on the volume of air needed for the combustion of a cubic foot of the given gas, partly on how much of this air is drawn in and mixed with the gas prior to combustion, and partly on how thoroughly and uniformly the air and gas are mixed.

Now the pre-eminence of efficiency of high-pressure lighting depends on the high flame temperatures it develops; and these are secured by the high "air to gas" ratio its burners secure, and by the thorough mixing of air and gas. Air is drawn into an atmospheric burner by the well-known injector action of the gas issuing from the nipple, by which a partial vacuum is produced in all directions round the rapidly moving gas, except, of course, in front of it; the degree of suction of this action depending on the speed of the issuing jets of gas. Gas issuing from small openings with a pressure of 60 inches behind it, naturally does so at a very high speed, and, consequently, draws in a greater proportion of air than usual; while the shape and internal arrangements of the tube assist in this and in securing a good mixing of the air and gas. The smallest flames, and consequent highest flame temperatures, are those obtained when the mixture is approximating the explosive limit. Some very interesting experiments were made a few years back with a view of developing high mantle efficiency in this way with ordinary gas pressures; but the promise of the earlier laboratory results was not substantiated in subsequent attempts. With the higher speeds of the air-gas mixture in high-pressure burners, an additional safeguard is obtained, which robs of most of its terrors the fear of a "shooting-back" of an explosive but highly efficient temperature producing mixture. Any gas explosion in a tube travels slowly and sometimes somewhat hesitatingly at first, and gets up a high speed as a second and distinctly noticeable stage. So that a rapidly moving explosive mixture may be able to counteract this comparatively slow propagation of the flame backwards, and keep a flame of maximum temperature at the burner head. Anything that tends to a higher flame temperature merits study and utilization if possible, as considerable accessions of illuminating power from incandescent mantles are obtained by even moderate increases in the temperature.

A LARGE AND FERTILE SUBJECT.

My remarks, I fear, have seemed somewhat discursive. I certainly have touched on a great many points, though I have neither exhausted the supply of those points nor the possibilities of any one of them. The subject of pressure crops up everywhere in connection both with our manufacturing and distributing operations. Its importance is supreme, and the need of a clear grasp of its applications self-evident. I only venture to hope that my words may start trains of thought in some minds, and that my attempt to express some familiar truths in less familiar phraseology may mean that for some of us our assent to them may be less languid, and that we may more intelligently hold and use them.

Discussion.

The PRESIDENT thanked Mr. Cranfield for the great fulness and clearness of his excellent paper, and remarked that, since the advent of incandescent lighting, less was heard of the once golden rule: "Keep down the pressure in the mains." This maxim was no doubt a sound one in the bygone days of luminous flat flames, where the production of the highest lighting efficiency was assisted by low pressure at the point of ignition, but hardly under present conditions. The advent of high-pressure lighting had brought wonderful results in connection with incandescent burners; and there could hardly be two opinions as to the value of working with even higher pressures on the ordinary mains than those which were now often employed. The best results, no doubt, could be obtained if an unvarying pressure could be maintained. Not many were able to attain this; but pressures could be kept at various points more in accordance with requirements, if records of pressure were periodically taken at these points—more especially during the hours of maximum consumption. Additions to mains, and new services, would affect pressures at some points, if increased pressure were not put on to compensate for the extra draw. Even if this raised difficulties in some places, a nearly constant pressure was necessary to allow for careful adjustment being made of burners, fires, &c., so as to secure their full efficiency, though it was not easy to find the most effective pressures, owing to the diversity of types of burners on the market. What pressure could do for them, and what he hoped it would eventually be doing on a large scale, was strikingly shown by the following figures: While 20 candles were obtained per foot of gas at ordinary town pressure, 12 inches pressure would increase this to 30 candles, and 60 inches pressure to 50 candles.

Mr. J. H. HILL said Mr. Cranfield might be unwittingly deterring some of the members from speaking on the subject by his insistence on the kinetic theory on the one hand and on the other by his references to the poetical and almost fantastic notions on pressure some folk entertained. They need not consider him heterodox if he admitted that he hesitated to too readily accept this theory, and made gentle fun of it; thinking some of the references made to it more worthy of being dubbed poetical than those to which the speaker had objected. He wanted a theory that took more count of heat and the part it played in causing pressure. Was

heat merely motion, or was it a form of ether? Did it occupy space? He fully agreed with the speaker that the mere summoning of a name to one's aid was of no use. Everyone was too apt to hide ignorance under a big word; it was necessary to get at the facts behind the names. He took exception to the statement that gas issued from a retort at a temperature which was not that of the retort. He preferred to state the value of high-pressure lighting, not as accomplishing a higher value per cubic foot of gas, but per square inch of mantle surface. He had met with some consumers who, on the gas nipple getting impaired, had found that they obtained increased luminosity by closing one of the air openings; and they had accordingly gummed paper over it. How did Mr. Cranfield explain the obtaining of a better luminosity by precisely the opposite device to that adduced in his address—viz., a less rather than a greater air supply.

Mr. J. E. L. Cooper took up the defence of the kinetic theory against Mr. Hill, as regards the connection between heat and pressure.

Mr. W. N. Booth expressed the obligations of the members for the address, which was, he said, so comprehensive as to render the task of discussing it almost appalling. They were indebted for an introduction to the kinetic theory and its applications to their gas conditions; and, in spite of Mr. Hill, he must support the application. He hardly knew whether to congratulate or commiserate the members present that they had not been given the mathematics of the theory. Ever since Clark-Maxwell introduced the theory, it had been possible to explain mathematically all gaseous reactions, and even the heat phenomena; and it undoubtedly held the field. Mr. Hill's suggestion of heat occupying space was untenable in the face of such instances as the following: A cubic foot of water heated from 0° to 100° C. expanded about 8 per cent., and needed 6250 foot-pound-centigrade units. A cubic foot of air, in rising through an equal range of temperature, expanded about 30 per cent., and needed 30 units of heat. Did the heat then occupy 800 times as much space in the air as in the water? Mr. Hill asked how gas issuing from a retort could be otherwise than at the retort temperature. Doubtless an infinitesimally thin layer in contact with the retort walls would be at their temperature; but the others would not. In the case of simple gases, heat would pass through them without any being absorbed; they would only be heated by hot particles rebounding and penetrating the colder layers. A more complex gas, such as coal gas, would be somewhat heated by the passage of radiant heat; but it was to be remembered that the gas was in course of rapid movement out of the retort, and so did not remain long exposed to heating conditions. As regards plugging-up a burner air-hole, it was not exactly the flame temperature that mattered, but the mantle temperature produced from it. In the case of the burner Mr. Hill had quoted, if the gas supply through a damaged or clogged nipple became less than that for which the burner and mantle were made, the air supply was relatively too large, and the flame consequently too small to fit the mantle. If, now, some air were shut off, the flame became larger, the mantle was better heated, and its luminosity increased. He was glad Mr. Cranfield had directed attention to the question of stratification. Strictly speaking, of course, there was none; diffusion keeping the gas constant in composition apart from convection currents. He hoped the day had gone by when anyone would say, as was stated by an eminent person at an official inquiry, that water gas might go floating about in the mains in lumps for some considerable time because of its density differing from that of coal gas. On the other hand, most of them would be familiar with the troublesome phenomenon that had occasioned the use of the word "stratification—*i.e.*, sudden and almost inexplicable variations in the quality of gas delivered from the mains. His idea was this: The densities of the various gases in coal gas differed. Now, when gas under pressure suddenly came to a region of less pressure, the particles of the lighter gases having a higher kinetic velocity would respond more quickly to the reduced pressure against them, and bound forward. This would cause some degree of separation between light and heavy gases. He suggested the same line of explanation for naphthalene being deposited on a decrease of pressure—*i.e.*, when just getting clear of an obstruction. It was well to remember that pressure really referred to intensity of pressure, and not to total pressure. People often imagined that pressure on a large surface should overcome an equal pressure on a small area. The use of steam as illustrating the effect of temperature on pressure was hardly a valid one, as saturated steam was not a real gas. Also he was not sure that he had correctly caught the reference to the increase of pressure with elevation being the same for a heavy as for a light gas. It would hardly be exactly the same, as the weight of the heavy gas in the mains would be greater than that of a light gas, and so make an initial higher absolute pressure at the lower levels. It was impracticable to deal in one address with all aspects of pressure; but the question of friction in mains might be mentioned in their discussion. The kinetic theory presupposed a very large number of the minute gaseous particles in any given space—quoting from memory, some 70 millions per cubic millimetre. It was a moot point whether they were to be regarded as actually touching in their so-called collisions, or whether they simply slipped round each other. If one could imagine that there was no contact, there would be no friction. Experiments upheld the view that there was no actual friction as with solids. If the speed was low, there was practically no resistance; so resistance had to be explained by high velocity. The walls of the mains caught and detained some of the molecules, and formed an outer layer; and the internal layers were sliding over these. If accurately tested, the speed of the flow of gases in mains exhibited a gradual increase from the outside to the centre, and then a decrease to a minimum against the other side; the maximum velocity in the centre being about one-and-a-half times the mean velocity. Still the resistance had yet to be explained. There the kinetic theory came in. As one layer moved over a more slowly-moving one, particles from the slower stream became entangled in the faster—thus retarding its rate. This had been worked out mathematically; and it explained why the resistance increased about as the square of the speed.

Mr. R. Halkett emphasized the importance in distribution matters of the subject under discussion. Where 1 inch pressure was adequate formerly, now 2½ to 3 inches was necessary. At first the fear of increased leakage being thereby induced hung over engineers' minds; but the fear appeared to be needless. In fact, in some cases leakage seemed to have decreased, although, of course, this might be partly due to greater watchfulness induced by fear of increased leakage. Even pressure was greatly to be desired, as in fixing gas appliances they were naturally adjusted to the usual pressure; and then any notable increase meant trouble and inefficient working. If even pressure throughout a district at all hours was not easy to give, pressure registers could be systematically employed so as to find out weak spots. Then in some cases the remedy might readily suggest itself—extra pressure at the works, or a little boosting, or district governors. The problem was not easy in large towns whose gas supply was worked on the arterial system, as district governors could not be used, and one distributing centre might flood the district served by another. He thought the gas industry was on the eve of recognizing high pressure in the ordinary mains as an ideal, and even of dispensing with low-pressure distribution—simply governing-down the separate services.

Mr. W. Porritt would like to have heard discussed the question of high pressure as it affected the use of dry or wet meters and also registration. He certainly thought, if higher pressures were to come into use, meters ought to be tested under these pressures, and not as under the existing Act.

Mr. E. Garsed said he was glad of the insistence on the need of more consistent pressures during the 24 hours. What frightened many who would otherwise like to vary their practice with a view to securing this condition, was the fear of increased leakage. In his experience last year, in attempting more satisfactory and uniform pressures, they had lost 1½ million cubic feet of gas extra in supplying 2½ millions more. Even this had not frightened them, as the profits from the 2½ millions allowed for the loss of the cost price of the 1½ millions; and, above all, they had the advantage of satisfied consumers.

Mr. E. J. Sutcliffe, in proposing a vote of thanks to Mr. Cranfield, made an interesting addition to the incident of gumming paper over an air-hole of an incandescent burner. On his holidays he had found a house in Surrey where every burner had a plug of paper inserted in each air-hole. He was told that without this all the burners lit-back; but the adoption of this device prevented the trouble. Further questioning elicited the fact that the family had formerly resided in Liverpool, and had brought to their new home all their former burners. Consequently, burners that were suitable for, and gave the correct quantity of air for, 20-candle gas, as tested with a flat-flame burner, were entirely unsuitable for 15-candle gas as tested with a No. 2 "Metropolitan" argand, and gave such an excess of air as to lead to almost immediate lighting-back.

The vote of thanks was seconded by Mr. C. D. Cawthra and supported by Mr. J. H. Hill.

Mr. Cranfield, in reply, thanked the speakers for their kind words, and the members for their patient interest in what he feared was not wholly a lively subject. In delivering the address, he had been realizing the hopes and intentions of several years. In his very extensive acquaintance with students for the past twelve years, alike in classes and by correspondence, he had found pressure to be perhaps the most misunderstood part of all gas studies; and he had embodied in his address mainly what he had thus found it necessary to emphasize and to re-express in new terms, so that the less familiar words might provoke reflection, and lead to a firmer grasp of the truth. He had been the more pleased to address them as he had wished to stand by his friend the President, who had been of such exceptional help as Secretary during his year of presidency, when the Association was first formed. To help fill the programme during Mr. Scholefield's year of office was an especial pleasure. He had greatly enjoyed the banter of their heresiarch, Mr. Hill, and admitted some force in his retort about poetical conceptions. But to all Mr. Hill's strictures he could only reply in the words of an eminent living parliamentarian: "What I have written, I have written." He had chosen his language carefully, and endeavoured to be accurate and exact; and he could only hope that the perusal of the printed address might do more than the spoken word to bring conviction to Mr. Hill. In regard to Mr. Hill's suggestion that gas coming from the retort must be at the retort temperature, he would remind him that if so the mouthpieces and ascension-pipes would be red hot, while the Workmen's Compensation Act would have new terrors for his Company, as gas escaping in slowly charging a retort might then mean frizzled stokers. If he drew his hand through a bunsen flame, it did not come out at a temperature of 1300° C.; and surely he had seen imperfectly carbonized coal that was not red hot, though it had been a consider-

able time in the retort. Of course, anything remaining long enough in the retort would eventually attain the retort temperature; the time depending on the elevation of that temperature, the weight of the substance and its specific heat, and the amount of heat absorbed in any chemical decomposition it underwent. As he had emphasized in his address, one of the cardinal points in modern carbonization was the prevention of any considerable heating of the retort gas. He thanked Mr. Booth for his able speech, and for its helpful applications of the kinetic theory. He admitted the force of the objection to the steam illustration. With respect to the pressures in mains of a heavy as opposed to a light gas, he had borne in mind the difference in initial pressure caused by the difference in the actual weight of the gas mass in the mains, and had safeguarded himself by using the word "practically," when speaking of the rise in pressure being 1-10th of an inch per 10 feet in all cases. He was much interested in Mr. Booth's suggestion as regards naphthalene deposits on an obstruction, but would remind him of the general rule that the presence of a nucleus of particles round which or on which to rest was apparently a general factor in hastening condensation of vapours and crystallization of solutions. He thought the members might find it easier to follow his address when it was printed; and he ventured to hope that its usefulness might be thus extended and continued. He had prepared it with this hope in his mind.

SULPHATE OF AMMONIA MANUFACTURE.

SUGGESTIONS FOR SMALL WORKS.

By G. Stanley Cooper, B.Sc.

There are numerous small gas-works in the country where difficulty is experienced in dealing with bye-products in a satisfactory manner. Distance from a suitable market, lack of buyers, difficulties of transit, &c., are the predominant factors in bringing about a state of affairs which ought certainly to be remedied. The two chief bye-products are tar and ammonia. The former often finds a local sale. Failing this, it can be stored, and eventually sent to market when a sufficiently large quantity has accumulated. The ammonia, in the form of liquor, finds no local sale; and on account of its bulk, and consequent cost of carriage, it does not pay to dispose of it at any distant market. Owing to this fact, this valuable product is simply wasted; and its disposal is not at all an easy matter. At one place it is run from the settling tank into the sea, where, fortunately, sewage and rivers board inspectors do not examine. With the idea of using, at any rate, some part of this ammonia, the writer devised the experiment now to be described.

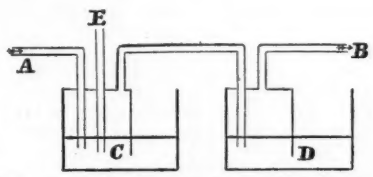
The ammonia in liquor consists essentially of two different kinds—"free" and "fixed" ammonia. The former consists principally of ammonia combined with sulphuretted hydrogen and carbon dioxide; and the ammonia so combined can be set free again by heating the solution. The latter consists of ammonia in combination with chlorine and other substances. In this case, it cannot be set free by heating alone, but has to be treated with lime. In an average liquor, we get about 42 to 44 grammes per litre of "free" ammonia compounds and 16 to 20 grammes per litre of "fixed" ammonia compounds. Generally speaking, about three-quarters of the total ammonia exists as free ammonia; and it is this ammonia with which we are chiefly concerned. Assuming that the process described could be worked satisfactorily and use up this proportion of ammonia, it would be of great profit to those gas concerns which at present make nothing out of, or even lose by, their ammonia.

A ton of coal yields, roughly, 26 to 28 lbs. of sulphate of ammonia, using both free and fixed. We could expect, then, 15 to 20 lbs. of sulphate from the free ammonia alone. The free ammonia usually contains about 85 per cent. of ammonium carbonate and 15 per cent. of ammonium sulphide. The former, when heated to a temperature of 60° C., breaks up into carbon dioxide, ammonia, and water; and the latter similarly decomposes, forming ammonia and sulphuretted hydrogen. Now, in the manufacture of sulphate of ammonia, the ammonia gas is passed into sulphuric acid. Carbon dioxide has no action on this acid; but sulphuretted hydrogen acts on the strong acid, decomposing it and forming sulphur, thus

$$H_2S + H_2SO_4 = 2H_2O + SO_2 + S.$$

It the mixture of gases therefore from decomposed "free" ammonia were passed into sulphuric acid, it would be necessary to remove the sulphuretted hydrogen or else eliminate its effect by using a weaker acid.

In the present experiment, the current of gas flowing in the main was made use of for motive power, and to carry the ammonia through the saturator and again into the main. The arrangement of apparatus employed is shown in the accompanying diagram. The gas was led through a pipe into the closed part of a vessel divided into two compartments. This vessel contained the ammoniacal liquor to a sufficient depth to make an effective seal at the partition. The object in having a divided compartment of this type was to render the process continuous and enable the liquor to be run off and replaced when required. Also leading into this vessel was a second pipe, through which a current of steam could be passed directly into the liquor, and so decompose the "free" ammonia compounds. This method of heating is preferred, owing to its involving less wear and tear of the vessel than does direct



A. Gas Inlet. B. Gas Outlet. C. Liquor Vessel. D. Saturator. E. Steam Inlet.

heating. From this liquor vessel the gas, now charged with ammonia, passed into a saturator—a vessel of exactly similar type to the liquor vessel. This contained the sulphuric acid; and here, again, more acid could be added as required without interfering with the flow of gas. Any sulphate formed could also be easily removed from time to time.

The carbon dioxide formed by the decomposition of the ammonium carbonate passed through the acid unchanged. To remove this, and also to prevent the gas from being too dry, after leaving the acid, the gas was passed through a washer containing water, thus removing most of the carbon dioxide.

The ammonium sulphide existing in the liquor is formed by the combination of ammonia with sulphuretted hydrogen. On decomposition of this sulphide by heating, the sulphuretted hydrogen is again liberated, while the ammonia is set free. Here it is that the trouble in the saturator is experienced; and great care is necessary to ensure that no decomposition of the acid takes place, with consequent deposition of sulphur. A small oxide purifier had therefore to be used after the gas left the saturator.

A little trouble was experienced at first owing to the occurrence of tar in the saturator; but this was eventually overcome by filtering the liquor through canvas. The sulphate obtained was fairly good on the whole; but traces of sulphur were occasionally found. The yield, however, was not up to expectations, being only about 6 to 7 lbs. per ton of coal carbonized. That the process is possible was nevertheless satisfactorily determined; and its ultimate development will likely serve to show its commercial possibilities.

DEPRECIATION.

At the meeting of the Junior Institution of Engineers on the 12th inst., Mr. H. F. Donaldson, Chief Superintendent of the Royal Ordnance Factories, delivered a lecture on "The Depreciation of Buildings and Machinery." He fears that the principles underlying depreciation are too often overlooked, and that in many hands the provision for depreciation is inadequate to meet the requirements of the case, while there is evidence occasionally that the amount of provision is recorded as having some relation to the largeness or smallness of the profits of the year with which the accounts deal. In his opinion, a depreciation fund should be one which will provide at any time during the life of the business definite evidence that the capital invested in the provision of buildings and machinery is realizable at the value originally invested in the concern under these heads. If this cannot be demonstrated, and clearly demonstrated, he would prophesy that the business would ere long be in difficulties from this alone, irrespective of any mistakes in the conduct of the business itself, to which all are liable. In his opinion, whatever sum is invested in buildings and machinery, that value should be maintained at its original level, partly by the existence of the buildings and machinery, which would, of course, stand in the books at value depreciating year by year, and partly by cash invested which represents these depreciation values. Depreciation funds are not, and ought not to be, matters which only interest the accountant. Useful and essential as they are to him in dealing with the financial condition of the concern, they are, and should be, of equal, if not greater, value to those entrusted with the management of the concern. Investigation of the various steps by which depreciation funds are built up will, without doubt, indicate not only whether, but when, a machine or building has declined in its earning capacity to such an extent as to demand replacement. Moreover, investigation on these lines will not only indicate the time when resort ought to be had to the scrap heap, but will also afford evidence as to how the products of the concern can be obtained on more economical lines than the old equipment is capable of. The existence of the depreciation fund is also advantageous to the management, as it largely mitigates the financial difficulties accruing to any scheme of modernization of an existing factory without either the need or the desirability of fresh capital, unless with the modernization increased capacity is also contemplated. Depreciation ought not to, and in fact, does not, depend upon the size of the profits of a single year's working; depreciation must be provided whether the profits are large or small, or even non-existent. Maintenance and repair charges are, and should be, entirely apart from depreciation levies, and form a direct revenue charge pure and simple. No amount of maintenance spent on buildings or machines should affect the assessment of the expected life of the building or machine for purposes of depreciation. The calculation for the life of the building or machine must be made on the supposition that both of them will be maintained in a thoroughly efficient and proper manner in all the usual requirements.

LIGHTING OF PUBLIC LIBRARIES.

The Illuminating Engineering Society had a joint meeting with the members of the Library Association yesterday week, under the presidency of Professor S. P. Thompson, D.Sc., F.R.S., for the purpose of discussing "Library Lighting." The interest shown in the subject was attested by the largeness of the attendance.

Views of the Borough Librarian of Islington.

There were three papers presented. The first was written by Mr. J. Duff Brown, the Borough Librarian of Islington; and in his absence, it was read by Mr. Bond, the Public Librarian of St. Pancras. It was pointed out in the contribution that the problems and difficulties in the artificial lighting of libraries were many. Like the ventilation of public buildings, their lighting has always been a contentious subject; but he confesses, after reading much and observing more, that his own personal feeling is in favour of getting as near to Nature as possible. For this reason, a plain open window, and a light as nearly like daylight as can be obtained, seem to him ideal conditions. In many cases, however, it appears to be impossible to get anything near to natural conditions, owing to the fads or mistakes of architects, and hot-water, ventilating, and electrical engineers. These specialists are nearly always in conflict; and as each has special requirements, every public building is the victim of a series of compromises and modifications which do not invariably yield satisfactory results. As regards libraries, these conflicting factors affect the artificial lighting in a number of ways, and each department somewhat differently. In dealing with these separate departments, he assumes that only electric light is contemplated; this being, he supposes, the most mobile, clean, and effective light for library purposes.

Believing it is quite possible to obtain a perfect artificial system of illumination in any building, provided the occupier is prepared to pay for it, the author says the human tendency to economize on the wrong things prevents this happy condition from being often obtained. Economy with regard to expenditure on lighting is compulsory as far as municipal libraries are concerned, owing to straitened means; and in a good number of cases this is the reason why many municipal library reading-rooms are badly lighted. Another reason is the fact that the lights have been arranged as symmetrically as possible to match the architect's ceiling-panelling, or other decorative whims; and the result is, in many cases, that while a pleasing design is obtained, it is only effective during daylight, because, as night advances, the room is merely illuminated by certain points of light, generally in the wrong places.

The lighting for a reference library in which readers are allowed access to the shelves must be arranged so that the book-shelves will be as well lighted as the reading tables; and it is necessary to light the books so that the titles can be easily read, and to avoid the shadows of the readers being cast over the shelves. This raises the question of local *versus* general lighting, on which considerable difference of opinion exists. In reference departments where access to the books by readers is not permitted, the question of lighting the book cases or stacks is quite a minor point, and only the reading-tables need be thoroughly well lighted. In general, where readers are not allowed access to the shelves, the books are arranged in stacks behind barriers, and not round the walls in alcove or other forms. The problem in the reference department then, is first how to illuminate reading tables effectively, while also, in the case of open access book-shelves, making the titles of the books and the classification guides perfectly clear to the readers. In news rooms or general reading rooms, the main problem is how to light newspapers spread out on sloping reading stands either arranged against the walls or standing across the room at right angles to the walls. If the lighting is arranged for each stand independently, it means that the fittings become fixtures—a disadvantage always associated with wiring which has to be conveyed along the floor and attached to tables or stands. For this reason the author's preference is in favour of having the lights hanging from the ceiling independently of furniture, so as to obtain complete adjustability whenever required. In lending departments arranged for indicator charging, it is necessary to have the indicator itself and the counter thoroughly well illuminated on both sides; and it has occurred to the author on several occasions that a long, tubular light arranged close to the indicators on the upper margins, so as to illuminate downwards, would be an improvement on any overhead system which casts the shadow of the borrowers over the numbers. He doubts, however, if the lower shelves would be as well lighted as the upper ones. Where readers are not permitted to have access to the book-shelves, the ordinary hanging lamps are quite sufficient, provided there is nothing in the construction of the book-cases to obstruct the light. The lighting of other departments is very much the same as in the three main departments dealt with. The author also advocates the attractive lighting of the exterior of the buildings.

The chief problems of library lighting may be summarized as follows: (1) Reading-room tables should be lighted so as to avoid glare in the eyes of readers. (2) To prevent the casting of strong single or multiple shadows of any kind. (3) To avoid fixing furniture or fittings in permanent positions. (4) To ensure the illumination of the room generally, as well as the tables. (5) In open access lending or reference libraries, the illumination of the book-shelves should be arranged so as to avoid as much as possible the shadows of readers falling on the books, and also to ensure the lighting of the lower shelves. To obtain these various results, it appears to the author that, whatever kind ot illumination is used, it is necessary in most cases to adopt general lighting, reinforced at all weak points by local lighting.

Views of the Chief Public Librarian of Croydon.

The second paper was by Mr. J. Stanley Jast, the Chief Librarian of the Croydon Public Libraries. He says that one may perhaps speak of two more or less distinct periods in the lighting of libraries. The earlier period is marked by general lighting, usually obtained from lights or clusters depending from the ceiling or roof, with little or no point or local lighting. The results have rarely been happy. It was no uncommon thing to see a roof or the passages between tables brilliantly lit, while the tables themselves were left in comparative obscurity. The results obtained by this happy-go-lucky system—by no means unknown even now—were worse as a rule when the source of illumination was an electric lamp. The absolute necessity of obtaining light where it was wanted, whether there was any light anywhere else or not, brought about the second and present period, in which the emphasis seems to be laid on point lighting, with a comparative neglect of efficient general lighting. He presumes there can be no question as to the undesirability of point lighting in itself, more especially when it is the primary source of illumination, and thus not subordinated to a scheme of general lighting. This being so, it appears to him that point lighting should be avoided wherever possible; and he contends that it should and could have been avoided in many recent examples of library lighting. One rarely sees in this connection proper treatment of the walls of the apartment, so as to provide good reflecting surfaces, and so aiding not only in the thorough diffusion of the light, but effecting considerable economy in the direct illuminating power. Where, as is the case in many reference libraries, the walls are utilized for shelving books, no reflecting surface other than the ceiling is, of course, available. Even then, however, if the book-cases are not carried up to the full height of the walls, it would probably be worth while to utilize a space above the cases in this way.

It is clear, however, that in many—perhaps in most—reference libraries point lighting for the reading tables or desks will be a necessary evil. The question then arises as to whether suspended lights over, or standards on, the tables are to be preferred. If a standard is chosen, what is the best height above the table and what design of standard, and, more important still, what is the best form of shade? The only scientifically constructed shade is, he presumes, the Holophane. The author's objection to it for table-lamps is that one has a bright light immediately above the eyes—not, of course, so accentuated as in the case of an unshaded lamp, but sufficiently annoying nevertheless. After trying several varieties of shade, he prefers, on the whole, the ordinary cone-shaped opal shade, as deep as it is possible to get it, so that the reader seated at the table is unable in any ordinary position to see any part of the lamp itself.

The special problem of library lighting is briefly that of generally illuminating a narrow gangway between book-cases, of an average width of from 3 to 4 feet, and at the same time lighting two vertical walls of books, covering an average width of (say) 9 ft. 6 in. to 10 ft., with an average height from the floor of about 8 feet. He is inclined to doubt if an absolutely satisfactory solution is possible. On the whole, he believes the best average results are achieved by lights over the centre of the gangway. The alternative is to employ lights on the cases. In his library, tuberlite or linolite lamps have been fitted on the cornices of the cases, so arranged that the lamp on one case lights the books on the opposite case. The result is fairly satisfactory; the main objection being that the lamp is fully visible to the eyes when examining the upper portion of the case. Fortunately, one does not expect readers to do more at a case than read the titles of the books required; while the absence of fittings projecting from the tops of the cases is a distinct æsthetic gain. He makes a suggestion for the use of linolite lamps as footlights—carrying them in a trough in the floor, with curved reflectors, and opal glass covering, and lighting the upper part of the cases by drop lights.

The points which occur to the author as those on which the opinion of illuminating experts would be valuable are: (1) Is it desirable to do away with point lighting as far as possible, relying wholly or mainly on well-diffused general lighting? (2) How far should wall surfaces be employed as agents of diffusion? (3) If tables are lighted locally, which is the most satisfactory form of shade? (4) What is the best solution of the specific library problem of lighting book-cases, especially when these are divided by narrow gangways?

An Architect's Views.

The third paper was by Mr. John Darch. He has a poor opinion of the lighting of public libraries. There is not, to his knowledge, a library in London—if in England—however luxurious it may be in other respects, that is provided with satisfactory lighting arrangements; most of them being illuminated in a manner that would answer equally well for a warehouse or a restaurant. Experiences of library building and fitting lead one to the conclusion that there is no alternative but legislation. If an Act of Parliament has been found necessary for factory lighting, it is clearly no less necessary for the public library, the owners or controllers of which should be compelled to provide sufficient and satisfactory illumination or close the library as a public nuisance.

He maintains that the ideal must be the goal, and that in matters of public health it is false economy to stop short of it.

The first principle of library lighting to be emphasized is that there must be a general lighting of the reading-rooms, distinct from, and in addition to, the local lighting of desks, &c. To rely on general lighting alone, as is done in perhaps the majority of libraries, is a great mistake; being both a useless waste of light and a failure as far as reading utility is concerned. For general lighting, it is not necessary to have more candle power than will be required to see about the room. In his opinion, 0·75 foot-candle should be ample; and the light should be soft and well diffused, which it would be if the light were derived largely from the illuminated walls and ceilings. If the room is lofty, there is nothing better or more economical than an arc lamp; or, better still, a regenerative gas or Wenham ventilating-lamp, provided that it is well above the sight line. Whatever lamps are used, they should be placed only just far enough below the ceiling to avoid dark shadow contrasts thereon, and to admit of its being well illuminated. The worst general lighting is that which is most common. Yet it has been specially recommended by a library expert—viz., plain opal shade pendants at equal distances apart, and about 8 ft. 6 in. from the floor. In this arrangement, the ceilings and upper half of the walls are placed in gloom; and yet, go where one will, one cannot avoid the glare of one or more of the lights. Such an arrangement is at the same time wasteful of light and quite inadequate for reading. He disapproves of downward or other reflectors in general lighting, particularly the polished kind. For low ceilings, the lamps should be placed as high as the proper illumination of the ceiling will admit; and the direct light be kept from the eyes by means of opaque or semi-opaque screens, in which case the lamps should not be enclosed in obscured glass. Indirect lighting is also specially suited to low ceilings, in which inverted arc lamps may be used; or ordinary bracket lights screened from the eye level, yet arranged to illuminate the ceiling and walls, and which will give a pleasing and sufficient general light.

For practical purposes the most important light for the reader is, and must be, the local reading lamp. No general lighting will meet the case; for it would involve a wasteful and intolerable blaze in order to obtain sufficient light to read by. One point that the author makes is the importance of providing a separate light for each reader. Every librarian will at once cry out about the luxury of it and the cost. As to the luxury, let it be remembered that the necessities of to-day were always the luxuries of yesterday; and the separate light will be the necessity of to-morrow. As to the cost, it is really more economical. Shades are required for the separate lights; and their depth must be adjusted to cover the eye in sitting or standing.

The tendency of the librarian is to treat every reader alike. This sounds fair enough; but, in reality, it is very unfair, and is thrusting unnecessary hardship upon all classes of readers. Men's eyes differ. Some experience trouble from want of light; others from the glare of excess. Sometimes a reader gets bright white paper and large type; and he needs a quiet light. Later he may have dark paper, small type, or an indistinct drawing, and will need a strong light; while some paper needs a careful adjustment of the incidence of light. All this means that no two readers need the same light. It is, therefore, essential that every reading-lamp should be adjustable, and under the control of the reader. There can be a considerable saving in current expenditure without depriving the readers of the "luxuries" advocated by allowing them to switch on and off their own lights. Some librarians say that the public could not be trusted to deal with movable lamps and switching arrangements. It is a slowly dying prejudice. Public enterprise has over and over again shown that it pays to put confidence in the people. The author has been in the South Kensington library when every light has been going with scarcely a reader. He has seen nearly all the Patent Office tables empty. He has seen but five readers in both the reference library and news room of the Guildhall; but in each case all the lights were fully going, as though they were being used. Is this economy; and what has the taxpayer to say about it?

Much that the author has said applies with equal force to the news room. In the majority of libraries, although there is often a brave show of lights, the stands are badly and unequally lit. The best arrangement the author has seen is at Cripplegate. The newspaper stands are 8 feet long, for two newspapers a side, and 2 feet from the end of each—in the centre of each newspaper—is a bracket lamp at about the level of the top of the stand, and projecting 15 inches. A light of about 3½ foot-candles is thereby obtained from only an 8-candle power lamp. Here you have a really splendid light for a small expenditure. On the other hand, the lamps are painfully visible whichever way one turns. A simple improvement would have been to have had deeper shades, and to have them directed towards the newspapers.

In his concluding words, the author said that whatever may be the need for free access to our great literature, there exists an equal or greater need for the very best facilities for the study of it—more particularly in view of the increasing degeneration of the eyesight of the modern student.

Points from the Discussion.

The discussion, so far as it was carried by those directly interested as librarians, did not add much of value to the papers; but the members of the Illuminating Engineering Society will have their turn at the subject at a special meeting a week hence. Before the librarians were invited to speak, Mr. Gaster called attention to the fact that a few years ago the first President of the American Illuminating Engineering Society was appointed illuminating engineer, in conjunction with an architect, to the Carnegie libraries. They came to the conclusion that naked lights burning about a reading room should be avoided—that glare should not be permitted under any consideration. They employed the Holophane shade. The lamps were fixed at a certain height so as to protect the eye of the reader; and the construction of the shades was such that the light was distributed not only downwards, but sideways. After careful investigation, the conclusion was arrived at that 5 foot-candles was the right amount for the purpose. It was found that too much light came out at the tops of the lamps, so they covered each lamp with another large shade, of a form which also prevented the rays coming into the eyes of the reader and so avoiding discomfort. The lighting of the Patent Office Library and of the library of the Institution of Electrical Engineers was later criticized by the speaker. Then Mr. Dow gave an account of certain illumination measurements he had made at different libraries. A point that had struck him in his investigations was the great diversity of conditions that was met with; and this led him to the conclusion that each case and each room, in regard to its lighting, must be separately considered. But he rarely met with a case where the intensity on the books was seriously too low, though in some cases not so high as it might have been. Exposed lights were present in many cases. Another point that struck him was that, on the whole, the ideal system was local lighting, *plus* some form of general illumination. He then referred specially to the lighting of various libraries he had examined; and in most cases there were points to be criticized.

Speakers followed representing the libraries at the British Museum, the Patent Office, the Board of Education, the Reform Club, and University College; but their contributions were of a general character, and did not add much to what had gone before as to general requirements. Mr. C. T. Davies, of the Wandsworth Public Libraries, was disappointed that something had not been heard on the subject of gas *v.* electricity, and the relative costs. At their West Hill library, they had decided, under all the circumstances, to use gas; and in all positions there one could see to read very well. Then Mr. William Whitaker, F.R.S., who is, we believe, a member of the Croydon Libraries Committee, remarked that he was pleased to find that people were realizing that there were libraries and libraries, readers and readers, and eyes and eyes; and never in this world would librarians, architects, or illuminating engineers, or all three together, succeed in satisfying every reader or every eye. The abnormal people must suffer; and if they satisfied the great aggregate, that was all that could be expected. It was a subject that could only be attacked in the true scientific method by experiment. It was the only way by which true and permanent advance could be effected. Following was Mr. L. Inkster, of the Battersea Public Library; and he said that he could assure Mr. Davies that he was glad to give up gas ten years ago. They were, however, still experimenting with the electric light; and he did not think they had yet got things perfect. They were, however, trying to adapt the light to the different conditions of the different rooms; and they hoped to succeed in course of time. Mr. Frank Pacy, of the Westminster Public Libraries, thought that those who had the principal responsibility in this matter should be independent, and in a position to appeal to a body like the Society of Illuminating Engineers for advice, and not be committed to the advice of aldermen, councillors, committees, or engineers associated with other municipal departments. Although a corporation possessed an electrical engineer, he was not necessarily the best person to advise on the lighting of a building.

Before adjourning the discussion, the President alluded to Mr. Davies's expression of disappointment that no one had referred to the relative costs of the two illuminants—gas and electricity. Had any member of the Society dared to raise the question, he (the President) would have had to intervene. Their duty there was to discuss the distribution and properties of light from whatever source it came; they did not discuss particular interests. But the matter went farther than the position taken up by his friend Mr. Whitaker. He (the President) heartily agreed that they had to have recourse to experiment; but after they had made the experiment, they need not always be experimenting over and over again. It appeared from what they had heard that, for table and desk lighting in libraries, they must have a minimum of 4 to 5 foot-candles; while for shelf lighting, they wanted about 1½ foot-candles as a minimum. If this could be insisted upon for library lighting whatever the source of light, they would have gone a long way. At any rate, they now had something definite upon which to go. They knew what they wanted; it could be specified; and library committees should see that they got from the contractor or the architect that which they knew to be desirable in the matter of lighting.

Projected International Gas Exhibition at Amsterdam.—We learn from Heer J. van Rossum du Chattel, the General Manager of the Amsterdam Municipal Gas-Works, that the new Zuider works will be opened at the end of next year; and that it is intended to hold in the summer an international gas exhibition, in which it is expected English firms and others connected with the gas industry will take part. Full particulars in regard to the exhibition will be published in due course.

REGISTER OF PATENTS.

Recovery of Tar, Tar-Vapour, and Ammonia from Distillation Gases.

RADCLIFFE, J., of East Barnet.

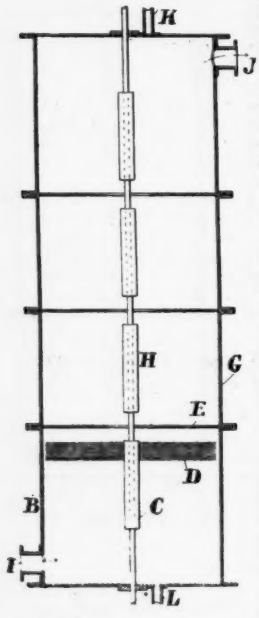
No. 28,868; Dec. 10, 1909.

The patentee proposes to pass the hot distillation gases to scrubbing apparatus, the scrubbing medium of which is oil, which "arrests the tar particles and vapour of tar contained in the hot gases at such a temperature that the water vapour is not condensed" but remains as vapour.

It is obvious, he points out, that the temperature of boiling of the oil should be suited to the temperature to which it is exposed; so that it shall do the required work in the liquid state. At the same time, an evaporation of a part of it, and subsequent condensation, will promote the extraction of the tar. There may therefore be one scrubber or similar apparatus working at a high temperature, which may vaporize part of the oil, while a second apparatus (conveniently a scrubber, to which the gas passes from the first) may work at a lower temperature. The fall in temperature may occur naturally through heat being given off into the atmosphere; or it may be artificially produced by the interposition between the two scrubbers of a condenser-scrubber or other cooling vessel. The condensate which results in this second scrubber may be circulated to the first scrubber.

While it is desirable for economical reasons, he continues, to condense in the second scrubber all oil vapours thus added to the gas in the first scrubber and abstracted therefrom as described, it is to be noted that the presence of such oil vapours in the gas passing to the saturator may cause tar vapour to be held, which, however, it will fix for practical purposes—that is, prevent its condensation in the saturator, and upon combustion the heat value will be recovered.

With regard to the scrubbers, any form of apparatus may be used for bringing liquids into contact with gases—modified, if necessary, for working at a high temperature. The patentee recommends a form like that shown in vertical section. The lower division B of the casing being placed in position, a collar C, carrying bristles D (of which only a few are shown), is slipped on the patent shaft and keyed. The circular plate E, having a central hole, is next fixed. Then the next section G of the casing, with its collar H; and, in like manner, the succeeding sections are built up. The gas enters at I and leaves at J. The oil enters at K and leaves at L. The oil leaving at L is, in the case of one scrubber only, pumped up to the inlet again; but in the case of two scrubbers, the oil leaving L in the first scrubber is taken away to be burnt or otherwise treated, while that from the outlet of the second scrubber is taken to the inlet of the first one. The plates E give a traverse to the gases, and also collect the oil which has been thrown against the sides of the casing, re-delivering it towards the centre of the mass of bristles. The bristles are so shaped in cross section as to present a large wetted surface to the current of gas.



Radcliffe's Tar Scrubber.

Having thus provided for the disposition of tar and tar-vapour and for the retention of the water in the gas as vapour, the gas is passed into a saturator—desirably providing for increased contact because of the increased dilution of the ammonia, and increasing the temperature if required. A multiple arrangement of saturator is employed; the strength of acid used being such that sulphate of ammonia is precipitated from the supersaturated solution in the lowest or first of the series to which the ammoniacal gas is admitted, without necessarily recovering all the ammonia from the gas. The gas then passes to an upper one (or series) to which acid is supplied continuously, in quantity depending upon the input of ammonia, overflowing to the bottom of the series or pair. The sulphate may be removed in the usual way, and the water vapour passes away along with the combustible gas for further treatment or burning.

It is a feature of the process that it is worked at a temperature sufficiently high to prevent the condensation of water vapour in the saturator, without the addition to the gases of extraneous heat or extraneous gases.

In order to recover tar saleable as such, the hot gases coming from the retort may first be passed to any suitable apparatus for the collection of tar particles, and the temperature of the gases may be reduced to promote this; but this reduction of temperature, the patentee remarks, does not result in any substantial condensation of water vapour.

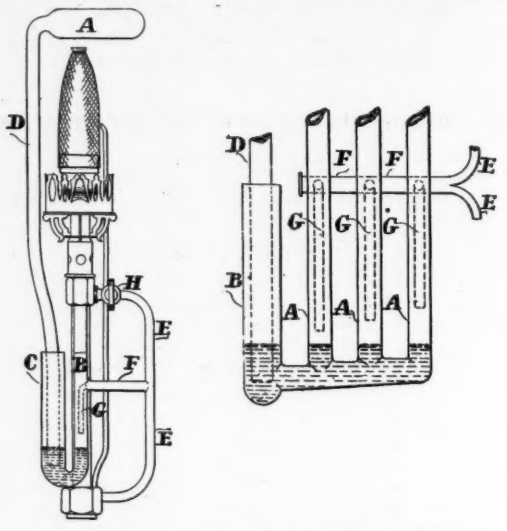
Intermittent Supply of Gas to Burners.

CHIPPERFIELD, W. H., of Hanway Street, W.

No. 18,683; Aug. 13, 1909. Post-dated, Feb. 14, 1910.

This invention is particularly applicable for use with illuminated advertising devices; the object being to automatically cut off and renew the supply of gas to a burner, or series of burners arranged in any desired form. It is a modification of patent No. 30,121 of 1897.

The illustration shows an air-chamber A, placed in position above, and within the zone of heat from, the burner, which is connected by a pipe with one arm B of a U-shaped tube containing mercury. The other arm C of the vessel receives within it a pipe D; communicating with the air-chamber A, and extending within the arm C, such a distance that its lower open end will be immersed in the mercury, and sealed thereby. The gas supply pipe E has connected to it a pipe F, leading into the arm B. The downwardly extending arm G is somewhat above the height of the mercury. When the tap H is open, the supply of gas to the burner will be constant, and not affected by the



Chipperfield's Intermittent Supplier of Gas to Burners.

rise and fall of the mercury in the arms B C of the U-shaped vessel. When the desired temperature has been obtained in the chamber A, the tap may be closed, when gas to the burner can only pass by way of the pipe F and arm G to the burner pipe; the supply in this case being subject to the opening and closing actions of the mercury in the U-shaped vessel.

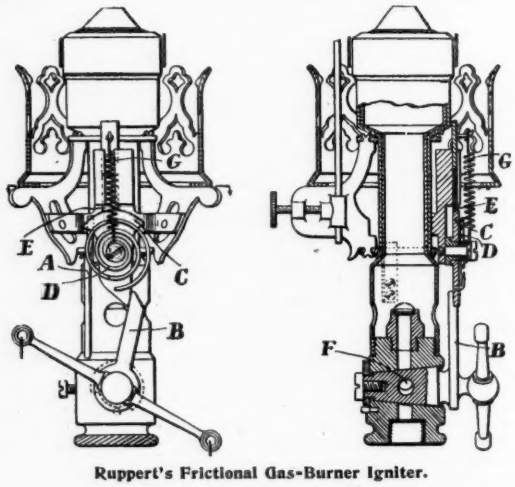
A convenient arrangement for fitting the U-shaped tube to any number of burners for illuminating devices, letters, or numbers, as required, is illustrated. Here the tubes G would be closed successively by the rise of the mercury in the tubes B, thereby extinguishing the light at the burner to which they are respectively connected. The fall of the mercury, consequent upon the decreased temperature, successively opens the tubes G, thereby again permitting the passage of gas to the burner, and the illumination of the letters.

Igniting Gas-Burners.

RUPPERT, H., of Zürich, Switzerland.

No. 29,606; Dec. 17, 1909.

This invention relates to gas-burners provided with means which, on the burner-cock being opened, scrape particles from an alloy of a rare earth-metal and iron, thus causing sparks, which ignite the issuing current of gas—the igniting device being located outside the range of the flame.



Ruppert's Frictional Gas-Burner Igniter.

The operation of the mechanism shown is as follows: When the burner-cock is closed, the gas supply both to the burner and the ignition tube A is cut off. If, however, the cock is opened, its arm B will bear upon the tail of the scraper C, and, overcoming the action of the spring D, will turn the scraper against the bar E. At the same time a recess in the plug arrives opposite the mouth of a channel whereby the gas, entering through the partially-opened passage F, has free access to the tube A, out of the top of which it will issue. On further rotation of the cock-plug, however, the arm B releases the scraper C, and the latter snaps-back under the action of the spring D, and in doing so its roughened periphery scrapes minute particles from the bar E, and casts them in the direction of the orifice of the tube A. The sparks thus occasioned ignite the gas from the tube, with the result that a flame shoots up to the level of the burner, and the gas is lighted.

Just as the cock fully opens, the passage through it will be shut, and the ignition-flame be extinguished. On closing the cock, its arm B returns to its initial position of rest without (or practically without) actuating the scraper sufficiently to generate sparks, as it is turned through only a small angle by the lever when being returned.

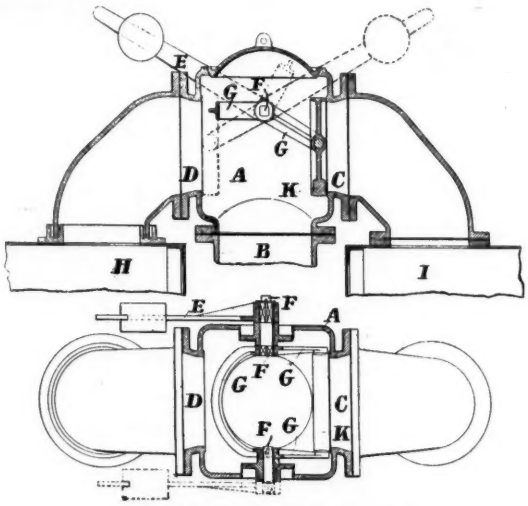
As the substance of the bar E wears away, it is drawn down tight against the periphery of the scraper by the spring G, so that they always remain in contact. Since the scraper C and the bar E are below the burner head, and are thus outside the flame, the scraper is not exposed to any intense heat, and thus retains its hardness.

Controlling the Flow of Gases from Retorts or Coke Ovens.

JOHNSON, J. Y.; a communication from the Maschinen and Armaturen Fabrik, vorm. Breuer and Co., of Hochst-on-the-Maine, Germany.

No. 30,198; Dec. 24, 1909.

The patentees say: "It is known that the gases generated when coal-distilling retorts are first filled are, on account of their composition, not led into the hydraulic main, but are allowed to escape directly from the distillation space into the open air—thus becoming a nuisance, and causing damage in the vicinity of gas-works and coking-works; and it has lately been frequently required that such works shall collect these gases, or conduct them away in such a manner that they shall not be a nuisance."



Breuer's Hydraulic Main Controller.

It has already been proposed, they say, to use a double conical valve operated by a counterweighted lever for simultaneously controlling passages to the hydraulic main and to the furnaces of gas generating plants; also a disc valve connected to the ascension pipe has been proposed for simultaneously controlling outlets to the hydraulic main and to the atmosphere. Their particular arrangement for the purpose is shown in vertical section and plan (partly in section). The valve casing is fixed directly to the top of the ascension pipe B, and is provided with a removable cover and with valve seatings around orifices C and D, leading to the hydraulic mains I and H respectively. The valve K is so arranged that, by the simple operation of throwing over a counterweighted lever E, one valve passage is closed and the other passage is opened—the valve being mounted on a pin carried by the ends of a yoke-piece G fixed to centre pins F, capable of turning in bearings in the casing. The lever is secured to one of the pins, where it projects outside the casing, or the yoke-piece may be replaced by two arms, one on each of the pins, and a counterweighted lever be secured to each pin projecting from each side of the casing.

The full lines show the position when the valve K closes the passage to the main I and leaves the passage to the main H open; and the dotted lines show the position when the lever E has been swung over and the passage to the main H closed and the passage to the main I left open. The advantages claimed for this arrangement (in addition to the ease of operation) are that the closure is tighter than with the valves formerly used for the purpose, and that cleaning of the ascension pipe is readily performed when the cover is removed, because there is no contraction of section either in the valve casing or in the ascension pipe. The starting of an installation fitted with this valvular arrangement is also said to be less dangerous and less troublesome than is the case with former arrangements, because, when the gases are to be turned into the hydraulic main, only the levers need be thrown over, whereas formerly the operations were not only troublesome, but also attended with danger, as explosions were liable to occur in the hydraulic main and pipes if the greatest care were not taken.

Ferrules for Gas and Water Pipe Connections.

DONNELLY, S. H., of Letchworth, Herts.

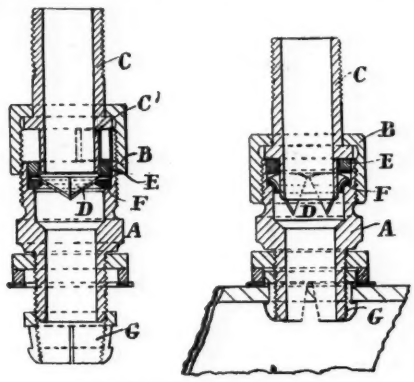
No. 735; Jan. 11, 1910.

This invention relates to apparatus for drilling, tapping, and inserting ferrules for service pipes in gas and water mains under pressure, and an improved ferrule for use therewith, as described in patent No. 10,335 of 1908. It has for its further object to improve the construction of the ferrule referred to by giving a less obstructed passage through it, and to reduce its size; also to provide for the attachment of the ferrule to light steel or wrought-iron mains or pipes.

In the present invention, the ferrule is a straight full-way ferrule having an extension on the union tail-piece for opening the valve, as described in the 1908 patent; but instead of the screwed-in seating and cylindrically extended valve there mentioned, the valve consists of a slightly cone-shaped (or flat) disc of metal divided into segments or petals—the outer edges resting on a seating close to the outlet end of the ferrule, and secured by a short screwed nipple; a rubber or leather packing ring being inserted between the nipple and the valve. The valve is closed by a spring acting on the underside of the valve, or by fluid pressure from the main.

The segments are so faced as to meet closely (fluid-tight), and are hinged to the seating or to the nipple, so as to allow of opening or closing the valve by inserting or withdrawing the union tail-piece.

In order to allow of the ferrule being fixed to pipes where the metal is too thin to allow of the usual screw-threaded joint, there is attached to the externally screwed inlet end of the ferrule a split tapered nipple screwed internally, and having the upper and lower edges thickened—the lower end projecting a short distance into the main. This projecting portion is riveted against the inside of the main by forcing the inlet end of the ferrule through the tapered nipple after the nipple has been fixed in the hole drilled for its reception.



Donnelly's Main Tapping Plant.

The illustrations show the ferrule with the cone-shaped valve in the closed position and having the split tapered nipple for light mains attached, and the metal block inserted; also the same ferrule in the open position with the metal block removed, and the method of connecting to light mains by the split tapered nipple.

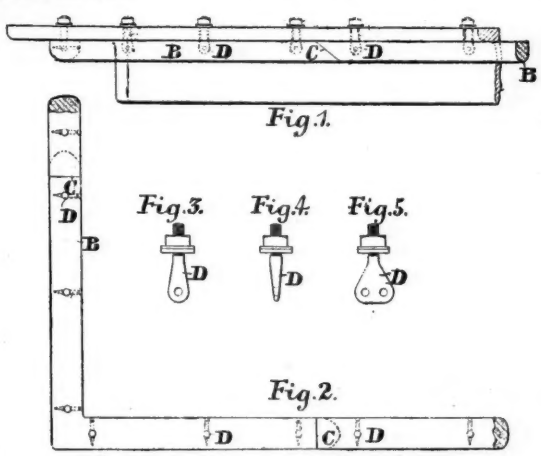
A is the ferrule body; B, the union; and C, the tail-piece, with the extension C¹ for operating the valve D. The nipple E keeps the segments of the valve in position; a leather or rubber packing ring assisting to make a fluid-tight joint. The elastic spring F assists in keeping the valve closed. G is the split tapered nipple with its back-nut and packing material for making the joint to the main fluid-tight.

Fastening Indiarubber Pads to Gas-Purifier Covers.

MILBOURNE, R. J., of Muxton, near Newport, Salop.

No. 6071; March 10, 1910.

This invention relates to means for attaching indiarubber pads to the angle-iron curbs of purifier and other covers, comprising eye-bolts designed to engage with holes in the curb of the cover and having their eye extremities embedded in the rubber pad in which they are secured by means of screws or pins passed transversely through the pad and engaging the eyes.



Milbourne's Fasteners for Rubber Purifier Pads.

Fig. 1 is a side elevation of a portion of the curb of a purifier cover, to which an indiarubber pad is affixed according to this invention. Fig. 2 is a plan of a portion of the pad. Figs. 3, 4, and 5 show the eye-bolts used.

The indiarubber pad B, applied to the under surface of the curb, is made in a number of lengths, with adjacent ends bevelled as at C. D are the eye-bolts inserted into the pad at suitable intervals—being preferably arranged in closer proximity at the joints between the lengths of the pad. Each bolt has its eye end embedded in the rubber; while

the screw-threaded shank projects from the upper surface of it. The embedded end of each of the bolts is, in practice, made of a flattened shape; the flattened extremity being formed with one or more eyes. E is a pin inserted laterally in the pad so that it enters the eye of the bolt. The pins extend transversely through the thickness of the rubber, and securely retain the eye-bolts in place in the pad.

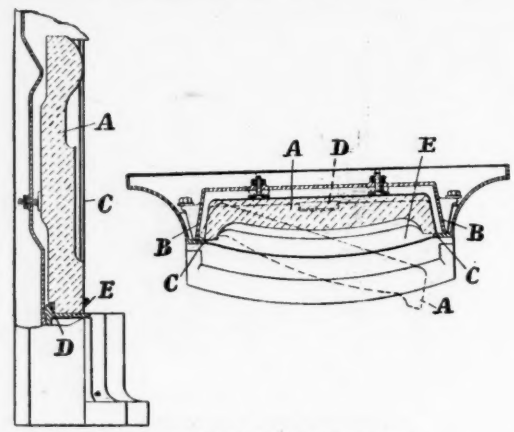
The screw-threaded shank ends of the eye-bolts are passed through holes in the curb, and the projecting ends receive nuts and washers as shown.

Gas-Fires.

YATES, H. J., of Aston, near Birmingham.

No. 8564; April 8, 1910.

This invention relates to heating appliances of the type with which a detachable refractory back is employed in conjunction with refractory fuel or "radiants," for the purpose of obtaining "effective radiation of heat generated by the combustion of the gas."



Yates's Fire-Brick Back for Gas-Stoves.

The fire-brick back A is made in one piece, with a curved or shaped front face, the surface of which is fluted or otherwise treated to suit the particular form of refractory fuel with which it is to be fitted.

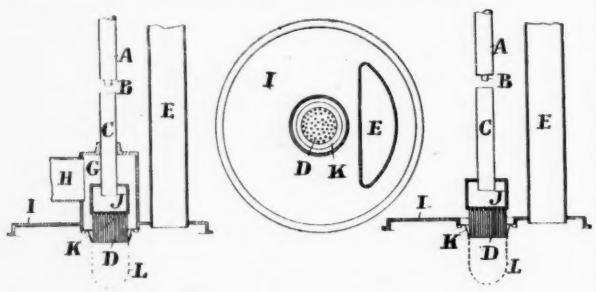
The width of the back exceeds the width of the ordinary front opening of the grate; but it is narrower than the ordinary recessed sides B of the grate immediately at the rear of the front opening. It can thus be placed in position by one end being first inserted through the front opening and moved as far over as possible against one of the sides to enable the opposite side to pass through the front opening of the stove. The back (adjusted laterally so that each side of it is sufficiently overlapped by the front edges C of the grate) is secured preferably by the engagement of a snug or projection D on the supporting plate E of the grate, or on the back casting of the stove, with a recess provided in the rear surface of the back. In alternative arrangements, two or more snugs and recesses may be employed; also the respective position of the snugs and recesses may be interchanged. The detached position of the back is shown by dotted lines.

Inverted Incandescent Gas-Lamps.

LUCAS, P., of Südende, near Berlin.

No. 13,017; May 28, 1910. Date claimed under International Convention, May 28, 1909.

This improvement in inverted incandescent gas-lamps is said to enable the lamp to burn the maximum possible quantity of gas in spite of a comparatively small cross area of the burner; the chief improvement consisting in "removing the chimney from the burner and disposing it on the cover outside the burner, so that the excessive preliminary heating of the air supplied to the burner is dispensed with."



Lucas's Inverted Incandescent Gas-Burners.

The gas-tube A of the lamp is provided at its lower end with a nozzle B (of any known construction), adapted to project the gas in a jet into the mixing-tube C and to inject the smaller part of the air admitted through the annular space between the neighbouring ends of the two tubes A and C. The mixing-tube passes through the cover of a casing G, made in one with the cover I, and be connected at its lower end with a mixing-chamber J. The bottom of the latter carries a number of pendent thin tubes forming the burner D. The casing is connected with a tube H on one side, through which the larger part of the air required for the combustion of the gas is admitted. A suitable ring closes the lower end of the annular space between the inside of the casing G and the outside of the burner D, and is adapted to carry the mantle.

The long and wide chimney E is removed from the burner D and placed on the cover I outside the burner. It may have any cross section; the essential point being that its cross area should be sufficient for sucking in the secondary air through the tube H and the casing G, and between the thin tubes of the burner D, to the flame, and for discharging upwards the products of combustion.

As the chimney is removed from the burner, the weight of gas and air passing through the burner will be increased; "so that a long homogeneous flame is produced." Such a flame presents the advantage, it is pointed out, that, on the one hand, the horizontal illuminating effect of the mantle is essentially increased, and, on the other hand, owing to the rapidity with which the air drawn into the casing mixes with the mixture of gas and air, a flame is formed, in which complete combustion takes place even in the interior of the flame.

The disposition of the chimney E on the cover I, removed from the burner D, further permits it to entirely dispense with the casing G; so that the burner D is fully exposed to the surrounding air, as shown in the modified lamp illustrated. When the globe is removed or breaks, the sucking effect of the chimney upon the burner ceases, so that no air passes downwards between the thin tubes of the burner; on the contrary, a small upward draught between the tubes will take place. Then the flame changes its direction and passes upwards. As, however, the cross area of the burner-tubes only suffices for the passage of the air required for the complete combustion of the gas if the chimney does exert its sucking effect, it is obvious that when the chimney ceases sucking in air the gas can only be burnt completely if air is supplied to it from above. This is rendered possible by the fact that the burner is completely exposed to the surrounding air in the second form of lamp illustrated.

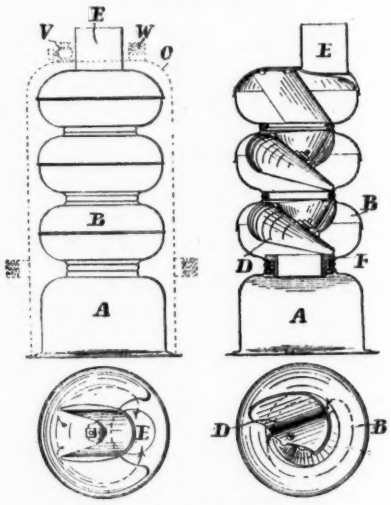
Gas Water-Heaters.

WILSON, H. F., of Armley, near Leeds.

No. 13,558; June 4, 1910.

This is an apparatus somewhat after the manner of that described in patent No. 589 of 1904, in which a large heating surface and small water-holding capacity are obtained.

A general view of the apparatus and a sectional elevation are shown; also plans of the deflectors looking from below.



Wilson's Gas Water-Heater.

The gas-burner is placed under a hollow casing A, having a central opening into which is fitted a hollow casing B, having a central outlet. A flange F is provided in the base of each casing; and against the flange rests one edge of the deflector D, which is attached to the upper interior face of the casing B at one side of the outlet. The particular deflector shown comprises two portions; the upper one being a segment of a hollow cone (the base being uppermost), and the lower one D a curved plate attached at right angles to the lower edge of the upper one. A deflector of this type is said to cause the heated products of combustion, which enter the casing at the central aperture, to impinge on practically the whole surface of the casing before they escape at the central outlet—the direction of flow of the gases being indicated by arrows. There may be any number of casings arranged one above the other. The upper casing is, however, by preference slightly different; the inlet opening being central, while the exit opening is to one side, in order to allow for the water-pipe W and air-valve V in the outer or water casing O.

The top deflector is also somewhat different in form to allow for this arrangement—comprising, as it does, a large strengthening plate attached to the upper part of the casing, and a semi-circular taper deflector attached to the strengthening plate, the lower edges of which rest on the flange of the central inlet opening. Connections for the water-pipe and inspection pipe are provided towards the base of the casing O.

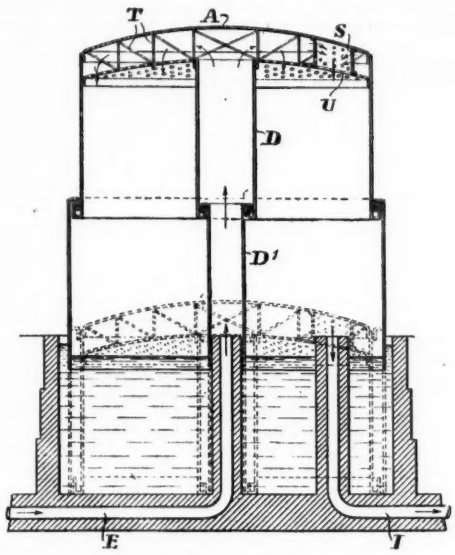
Gasholders.

OFENBAU G.M.B.H., of Munich.

No. 20,566; Sept. 3, 1910. Date claimed under International Convention, March 2, 1910.

This invention may be regarded as a modification of the feed device for gasholders forming the subject of patent No. 27,278 of 1909—see "JOURNAL" for July 5, 1910, p. 45—its object being "to ensure a

thorough mixing of the gas supplied through the telescopically adjustable feed-pipe, with the gas stored in the holder, throughout the whole cross section of the holder."



Feed Device for Gasholders.

A construction of the feed device for a telescopic holder is shown in vertical section.

Below the bell A of the holder is arranged a perforated cover F, connected to the bell by truss girders T and having its central opening connected to the upper end of the telescopically adjustable pipe D D^1. The gas carried upwards to the cover of the holder through the pipes E D D^1 is forced by the cover F to spread over the whole cross section of the holder and sink downwards in the direction of the arrows "in single fine gas-jets," when its specific gravity is greater than that of the gas stored in the holder. Owing to the division of the layer of gas in the cover of the holder into a number of single gas-jets, "the thorough mixing of the gas inside the holder is improved to an extraordinary degree."

At a point opposite the gas outlet pipe I, the cover F is provided with an opening or recess U, for the passage of the pipe I, in the lowest position of the bell; the opening being surrounded by a perforated jacket S built in between the covers A and F. Owing to this arrangement, the height of the uppermost portion of the bell is reduced to the greatest possible extent; and in its lowest position the cover F rests on a supporting scaffolding (not shown) arranged in the tank, the upper end of the pipe I passing into the cylinder S, as shown in dotted lines.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Publicity and Special Purposes Committee of the Institution.

SIR,—It has come to the knowledge of the Committee that some of the circulars issued on the 2nd inst. may have miscarried.

No communication on the subject having been sent to the chief officials of the undertakings, the Committee hope that they will take note of the terms of the circular (copy of which appeared in your issue of the 17th inst.); and, if the matter has not already been considered, that they will arrange for it to be brought under the consideration of their Committees or Boards, as the case may be, as soon as possible.

Copies of the circular may be obtained on application to this address.

39, *Victoria Street, S.W., Jan.* 20, 1911. W. T. DUNN, Secretary.

Analysis of Fire-Brick.

SIR,—Allow me to thank you for the insertion in the "JOURNAL" of the abstract of the paper, on "Fire-Bricks," which I read before the meeting on the Western Junior Gas Engineers Association during their visit to Bonnybridge in December. I am also much obliged for the criticism on same over the signature of Arthur A. Knox.

I am very much disappointed with Mr. Knox's letter. Instead of contributing any new or instructive matter, his point seems to be to demolish a chemical expert (myself), who is entirely his own creation. Mr. Knox is a stranger to me, and so far as I am aware I am an entire stranger to him; and his assumption as to my want of knowledge of practical chemistry (of which he can know nothing), and his reference to "careless" analyses which I have supplied, seem to me to be lacking in those qualities (care and precision) which I have understood to be the distinguishing features of the present-day chemical expert.

I do not quite follow his reference to present-day clays; my own opinion being that the matter of a few hundred (or even more) years does not make any material difference in the composition of fire-clay.

At the outset, he is under a misapprehension, as the intention of my paper (as he will see upon perusing the first paragraph) was to convey to the parties present, in the least technical language possible, some general information on the subject.

As regards the comparative analyses given in my paper, these exactly served the purpose which I intended—*i.e.*, to indicate broadly the differences between the various fire-clays used for commercial purposes in different districts in this country. It might even have served my purpose if I had combined the peroxide of iron, alkalies, moss, &c., in one column, under the heading "Impurities and Loss."

Had Mr. Knox perused my paper a little further, he would have found that I deal particularly with the impurities in fire-clay which he mentions; and I am pleased to see that the table I quoted is referred to by a chemical expert on another page of the "JOURNAL."

As regards the percentage of silica and alumina in ideal fire-clay, the statement in my paper was to a large extent the result of careful personal experiments; and I cannot do better than quote the following extract from a paper on a similar subject which I read before one of the Gas Institutes some years ago.

> The average chemical analysis of the best fire-clay contains approximately about 55 to 65 per cent. of silica, 30 to 40 per cent. of alumina, 2 to 3 per cent. of oxide of iron, and 1 to 2 per cent. of alkalies. It will be seen from this that the principal elements are silica and alumina. Both these minerals are only fusible at very high temperatures. The brick which has been found most suitable for ordinary furnace work contains an analysis of the above proportions of silica and alumina. It has been found that if this percentage of silica is increased, it has a tendency to lower the fusible point of the brick until it reaches a total content of about 90 per cent., while above this analysis the increasing amount of silica gradually raises the temperature of fusion until it reaches the melting point of pure quartz—*i.e.*, 3325° Fahr. On the other hand, if the content of alumina is increased, it renders the brick more liable to warp and twist during burning.

There need not, however, be a slavish adherence to 1 per cent. (neither more or less) of alumina or silica.

If Mr. Knox has even a rudimentary knowledge of fire-brick manufacture, he will be aware that in the manufacture of retorts there is a much larger percentage of grog used than for ordinary fire-bricks, and this to a certain extent will counteract the bad effect of the high percentage of alumina. I may state, however, that I recently had the opportunity of inspecting some retorts which are giving satisfaction, and which contained about 80 per cent. of silica. Bonnybridge bricks have as high as 43 per cent. of alumina, and as low as 10 per cent.; but these are not only costly to produce but are also unsuitable except for certain special purposes.

As regards the concluding paragraph in Mr. Knox's letter, if this is intended as a recommendation to gas engineers to use bricks with as high a content of iron as 5 to 6 per cent., even with the least possible trace of the other impurities yet discovered (and that such can be used with safety), I can only state that I do not agree with such recommendation. I think also that it will be unnecessary for me to issue a warning to gas engineers on this point, as I am quite sure they will avoid bricks with such a high percentage of iron.

Bonnybridge, Jan. 16, 1911. E. M. STEWART.

Electricity Supply Project at Holmfirth.

SIR,—In the last number of the "JOURNAL" (p. 185), you published a copy of the circular-letter (prepared by Mr. H. Marsden, of Honley), as sent to the ratepayers of Holmfirth, asking for support to be given to a proposed scheme of electric lighting, &c. Will you be good enough to insert, in your next issue, along with this letter, my reply to the circular of the Holmfirth Urban District Council? While I do not wish to criticize the action of Mr. Marsden, it would certainly be interesting to know as to whether your readers consider professional etiquette in the gas industry allows for the manager of a works assisting in the business of trying to convert to electricity the consumers of gas of his next-door neighbour.

A. E. BUCKLEY,
Manager and Secretary, Holmfirth Gas Company.

Holmfirth, Jan. 20, 1911.

[ENCLOSURE.]

Holmfirth Gas Company, Jan. 12, 1911.

Dear Sir, or Madam,—The Directors of the above Company have had their attention drawn to a letter which the Holmfirth Urban District Council have sent to the ratepayers, asking for support to a scheme which the Council have under consideration for supplying electricity throughout the urban district. This Company wish to take the earliest opportunity of warning the ratepayers against any such scheme as the Council are now desirous of launching upon the district.

The letter in question is of a most one-sided nature, and it will be observed that all comparisons as to cost have been carefully avoided; the only available information being that a light of 50-candle power can be obtained at a cost of 1d. for three hours' use, when using electricity at the extraordinary figure of 6d. per Board of Trade unit. The price of gas for lighting purposes in Holmfirth being 3s. 1d. per 1000 cubic feet, 27 cubic feet are obtained for one penny, which supplies an incandescent light, giving 60-candle power, seven hours for 1d. Thus a simple comparison is—

50-candle power electric light	*3 hours for 1d.*
60-candle power incandescent light . . .	*7 hours for 1d.*

It will be noticed from the Council's letter that there is no mention of such things as the cost of wiring premises, fittings, lamps, and maintenance, or meter-rents.

Ratepayers in the urban district of Holmfirth, while giving consideration to this question, will be well advised to bear in mind that to use electricity would more than double their lighting accounts; also that our heavy rates would in all probability have to be made still heavier to meet the expense of such a luxurious scheme.—Yours faithfully,

W. H. BARBER, Chairman of Directors.
A. E. BUCKLEY, Manager and Secretary.

The Sunbury District Council have entered into a contract with the Gas Company for the lighting of the district at a cost of £3 5s. per lamp per annum, the Company providing the mantles, and maintaining them in good condition. Previously, the cost per lamp was £3 9s. 3d.; but a saving of £90 per annum would be effected by the new arrangement.

MISCELLANEOUS NEWS.

KIRKCALDY GAS-WORKS PURCHASE ARBITRATION.

PROCEEDINGS IN EDINBURGH.

Friday, Jan. 20.

The hearing of evidence in connection with the transfer of the Kirkcaldy Gas Company's works (*ante*, pp. 107 and 174) was resumed to-day.

The Arbiters are: For the Company, Mr. CORBET WOODALL; and for the Corporation, Mr. ARTHUR SILVERTHORNE. They nominated Lord SHAW OF DUNFERMLINE as Oversman. Mr. NORMAN J. MACPHERSON, S.S.C., is Clerk to the Referee. The Company are represented by Mr. MURRAY, K.C., and Mr. MONCRIEFF (instructed by Messrs. Adamson, Gulland, and Stuart, of Edinburgh); and the Corporation, by Mr. CLYDE, K.C., M.P., and Mr. MACMILLAN (instructed by Messrs. Morton, Smart, MacDonald, and Prosser, of Edinburgh, and Messrs. Martin and Co., of London).

Mr. *E. H. Stevenson*, in reply to Mr. MURRAY, said he had visited Kirkcaldy on more than one occasion, and was of opinion the works were well situated for the supply of gas. The works and apparatus were in excellent order. The plant was thoroughly good. There was considerable surplus power, except in regard to the holders. These were of sufficient capacity for present requirements. He would suggest that the Pathhead holder might be used so that gas could be pumped back to the town from it. There had been a considerable increase in the last six years in the gas made and sold—from 115 million cubic feet to 125 millions. Nevertheless the maximum day's make was substantially the same as in 1902. There were 7652 consumers in private houses on the Company's books, apart from trade consumers. This showed an unexhausted field for the Company; there being some 1700 private houses not supplied with gas. He had no fear that there would not be an increased demand for gas in the future. Unaccounted-for gas was usually found, not in the main-pipes, but in the services. The Kirkcaldy figure was higher than usual. In his opinion, it could be reduced by attention to the pipes at a very reasonable cost indeed. It might easily come down 5 per cent. Apart from unaccounted-for gas, the undertaking had been very well managed. A reduction of 5 per cent. would mean a saving of 6 million cubic feet, or a clear profit to the Company of £250 a year. This would give a lengthened life to the works. The competition of the electric light had taken 11 million cubic feet of gas from the Company. In the Dunfermline arbitration, competition with the electric light was urged as a reason why the consumption would not increase. But the consumption of gas in Dunfermline had doubled in eleven years, whereas it took 22 years to double under the Company. He had proceeded in his valuation of the undertaking as a going concern and as a whole. He had also taken into consideration that it was a non-statutory concern, and that it occupied a peculiarly unique position. The price of gas in Kirkcaldy he considered very reasonable. It was a gas of permanent and very high quality. Unless they knew all the circumstances of every case, it was impossible to compare price with price. He thought Kirkcaldy consumers were getting as good value as those in any other town. He had looked into the public lighting, and found that, with the exception of a few street-lamps in which there were old-fashioned burners, it was very satisfactory. At the time he was there, the pressure was the same as was now being supplied by Mr. Macpherson.

By the OVERSMAN: The maximum day's output was 728,000 cubic feet; but there was retort power to produce 900,000 cubic feet a day, without trenching upon the reserve. If the reserve were in use, the maximum daily make would be 1,050,000 cubic feet.

Examination resumed: There were 104 retorts. It was entirely a financial matter whether it paid to introduce carburetted water gas. This was very largely determined by the cost of oil and the price received for coke. In Kirkcaldy, more gas per ton of coal was made than in any other Scotch towns, except Edinburgh, Glasgow, and Paisley. It was curious that the town which made the smallest quantity of gas per ton of coal had the lowest net price for coal. He did not understand it. It was curious that it happened practically the same in England. The Scotch town was Coatbridge. There they sold gas at the lowest price in Scotland; but they made so much out of residuals, because of the special quality of the coke, on account of the use made of it in works in the neighbourhood. The accounts showed that the Kirkcaldy Company had built up their business largely out of profits. This was quite common. It was illegal on the part of statutory companies to do this; but Kirkcaldy did it. He took the maintainable profit at £6603 14s. 11d. He had adopted 26¾ years' purchase as the basis. His reason for this was that he considered the Company in a very unique position. The shareholders had, in the past, been receiving 3¾ per cent. return on their money. Quite recently, shares had been bought in the public market at 100 per cent. premium. It might have been the shareholders would have got more if they had put their money into other gas companies; but then they would have had no local control. Unless it could be shown that the price at which the shareholders had invested was unreasonable, the Company should be purchased at least at the same rate as the shareholders had been receiving. The present purchase was very much a compulsory one. The vendors ought to receive the value of the undertaking clear of any costs of re-investment, or the costs of winding-up the Company, or the balance of the costs of the arbitration. Ten per cent. for compulsory sale was the sum universally claimed and universally given. Allowing for surplus power, he made out the valuation to be £200,240. He added the value of stocks shown in the balance-sheet (£11,029), and the value of gas in the holders at the time of the transfer (£39); together, £11,068. His total valuation was £222,615, which was slightly different from Mr. H. Woodall's, in respect of the valuation of lands. There was an easy profit, without any extension of works, of £7862. He estimated that the Corporation, borrowing £207,000 at 3½ per cent., would require to pay £7245 in interest, which would leave a surplus of £617. A further saving could be effected by supplying gas of lower illuminating power. He had no doubt the Corporation would follow in the footsteps of other companies and local authorities, and reduce the illuminating power to 14 or 15 candles. It was admitted that the lower illuminating power was the best for lighting, heating, and power purposes. The price of gas would then tend to be reduced, probably by ⅜d. per 1000 cubic feet per candle, which would mean a saving of £240 a year. This, *plus* the £617, would be more than sufficient for the sinking fund accumulating at the rate of 1½d. per cent. per annum. He thought that if the Company were to go to Parliament they would be gently or sympathetically dealt with, because, so far as he understood, until this question of purchase arose, there had been no complaint against them.

The OVERSMAN: You think that Parliament would approximate as near as may be to your valuation?

Witness: I think that practically Parliament would give the Company power to divide £6450 in dividends.

By Mr. MURRAY: He thought that Parliament would grant a standard price of 3s. 2d.

In cross-examination by Mr. CLYDE, witness said he thought that 3s. 2d. was a very maintainable price. The price of gas might be reduced from this figure without reducing the maintainable profit.

By Mr. SILVERTHORNE: He did not admit that the vendor should suffer any deduction in respect of sinking fund. The redemption should be by the gas consumers. It was not now the practice for Parliament, when the illuminating power was reduced, to give the benefit to the consumers. Parliament had before it last session the Test Burner Bills. It was admitted that an alteration of the burner would result in a benefit to the companies; and that this benefit would result, through the reduction of the price, in a benefit to the consumers. Parliament did not make any alteration in the standard or maximum price in any of the cases. He went further than this in the case of Coatbridge the previous session. The Company applied to Parliament to get their illuminating power reduced from 20 candles with a flat-flame burner to 15 candles with a No. 2 "Metropolitan" argand burner. The Coatbridge Corporation, for whom he acted, tried to get a reduction of the standard price to 2s. 6d., because it was admitted by the Company that they would at once be able to do so. He therefore asked Parliament to give them 2d.; but the Committee refused to make any alteration in the standard price. In the one case of Brighton, a reduction was made last year. Previous to this there were other cases in which a reduction was made; but he did not think there would be any more reductions.

Mr. SILVERTHORNE: Have you yourself asked twenty years' purchase?

Witness: Years and years ago. Dundalk was 22 or 23 years ago.

The CHAIRMAN: I gather from that that your view is that it is extremely difficult to make a general rule by doing anything in the nature of striking an average of prices received; and you object to such an average on the ground that everything depends upon the details of the individual cases.

Witness: It does entirely and absolutely depend upon this.

Your valuation would give £1700 per million cubic feet of gas sold?—I have taken that figure.

Can you tell me what was the Dunfermline price?—£1575; and I do not, in view of the price at Dunfermline, feel inclined to modify my view.

The OVERSMAN at this period intimated that he and the Arbiters had anxiously considered the question of the future of the arbitration. They had had four days before, and would sit the next day; and the remainder of the proceedings would take place at the Surveyors' Institute in London.

After a conversation, it was agreed that the date of the subsequent sittings would be fixed to suit the convenience of Counsel—Feb. 9 being suggested.

Mr. *Henry O'Connor*, replying to Mr. MONCRIEFF, said he made tests of illuminating power in a number of towns upon a 60-inch Letheby bunsen photometer. His practice was to take a room in a hotel, and make the tests there. At Dunfermline, on Oct. 17, he got an average of 15·19 candles; at Coatbridge, on Oct. 21, he got 14·91 candles; and at Alloa, on Oct. 19, 12·89 candles. He followed the usual method of making ten tests. On Oct. 26, he made a test at Kirkcaldy, and got 20·35 candles. In carrying out these tests, he did not give notice to the authorities or to the suppliers of gas in the towns, or their engineers. In 1906, he reported to the Kirkcaldy Town Council upon the lighting of the town. At that time, he employed a No. 2 flat-flame burner, the same as was used in the public lamps. He brought out a candle power of 23·6 candles.

Mr. *Thos. P. Marwick*, an architect, said he had examined the properties which were the subject of transfer. The gas-works covered about one-half of the total area available. His total valuation of the structures was £13,463. The site value of the land upon which the gas-works are built he gave at £14,860.

Counsel agreed to hold the evidence of Mr. *Alfred Morland* (Messrs. Wood, Drew, and Co., of London) as concurring with that of Mr. Marwick; and this concluded the case for the Company.

THE CASE FOR THE CORPORATION.

Saturday, Jan. 21.

The case for the Corporation was entered upon this morning.

Mr. *R. Cockburn Millar*, examined by Mr. CLYDE, said prior to 1897 the accounts of the Kirkcaldy Gas Company were not kept in the manner provided by the Act of 1871. He advised them in that year; and after that the accounts were kept more nearly in the form prescribed. He had seen the statistics prepared by Messrs. Wood, Drew, and Co.; and while they were accurate, they were in some respects misleading. In 1845, the dividend paid was 10 per cent., with a bonus of 10 per cent. Except in 1865, the dividend paid by the Company down to that year never exceeded 7½ per cent. In some years there was paid to the shareholders 2½ per cent. more, and in 1864-65 4½ per cent. In 1845, the agreement was entered into which provided that the dividend was never to exceed 7½ per cent. on the subscribed capital; and any new capital to be issued was to be sold by auction. These

were both provisions which favoured the consumer. The agreement also provided for the formation of sinking and depreciation funds. The Company adopted the conditions in the agreement under pressure of an immediate threat of competition, in view of their dividend of 10 per cent. In 1852, not only the 7½ per cent. was paid, but also an additional 2½ per cent., which it had been agreed the Company should be authorized to lay aside. This continued until 1865. In 1852, the price of gas was reduced from 6s. 8d. to 5s. 10d. per 1000 cubic feet. In 1851, the Company came to a resolution that their accounts and reports should be kept private. This was within six years of the agreement of 1845, and was the first departure of the Company from the agreement. There was renewed agitation on the part of the public in 1861. In 1853, it was moved and agreed to that no discounts be paid to consumers.

Mr. CLYDE: So that, apparently, following upon the decision to keep the reports private, and the payment to the shareholders of insurance money in order that they might insure themselves, there came the resolution not to pay discount?

Witness: That is so.

In reply to further questions, witness said that, so far as he could see from the papers, the renewal of the agitation in 1861 was concerned, in the minds of those who promoted it, with the observance of the old policy adopted in 1845. In 1864 and 1865, the shareholders were paid 7½ per cent. dividend, and 7 per cent. extra; the shareholders being treated as creditors to the extent of the 7 per cent. In 1866, this state of affairs was brought to an end. The capital was then doubled, and thereafter the shareholders received 7½ per cent. upon their originally subscribed capital, and 7½ per cent. upon the divided capital; so that they received 15 per cent. upon every penny they had put into the Company. In 1883, the Company was incorporated. The shares were again divided; and after 1888, the yield to the shareholders was at the rate of 22½ per cent. upon the capital actually put into the business by the original subscribers. If the Company had adhered to their policy of 1845, not a single penny of the money paid in premiums could have been credited to the shareholders in the way it was done. In 1897, the first proposal for the purchase of the Company was mooted, and £12,000 of new capital was created. One share was issued without payment for each three shares formerly held. This was done from reserves accumulated out of profits. In 1907, one share was issued to the shareholders for each share held by them, the effect of which was to raise the dividend on the originally subscribed capital to 30 per cent. In 1866, each subscriber had his capital doubled without any payment. He had a £10 share instead of a £5 one. In 1883, he had a further amount equal to his original holding—three £5 shares in place of a £10 share. In that year, his original holding was trebled in amount, without any payment to the Company in exchange for his shares. In 1907, for the third time, he had an addition to his holding, to the extent of one share for every three. The result was that his original holding was quadrupled in amount in eighty years—in fact, every twenty years of the life of the Company the money paid for a share in the undertaking had been paid back to him in the form of additional holding. This would influence the value of the shares; it would artificially inflate them. Since July, 1909, he found there had been 51 transactions in 571 shares. The average price realized was £9 per share, which represented a yield to the purchaser of 4⅛ per cent. At 8½ per cent., which was the dividend paid by the Company, the yield to the purchaser would be 4¾ per cent. A rate of dividend of 4⅛ per cent. represented 24 years' purchase, and 8½ per cent. was equal to 21⅛ years. When meters were taken out of service and kept in store, there was no entry to tell it. If meters were purchased for new properties, they were charged to capital. The Company had no entry equivalent to a debit for renewal of meters. They had an entry for meters broken up. The same was true of expenditure on mains and services. He thought they could not rely on the capital expenditure on mains and services. The length of mains recorded in the Company's books was greater than the length obtained by survey. If the people of Kirkcaldy had realized that all the time the Company were not only making 7½ per cent. on inflated capital, but were concealing profits, sometimes to the extent of 50 per cent., they would not have stood it. There was no instance in Scotland of any progressive town like Kirkcaldy where the price of gas had not been reduced more than the rate charged in Kirkcaldy. He estimated that the capital was £35,754 in excess of the actually paid-up capital. In his view, this was not a case of compulsory purchase. He found that it was on the intervention of the Kirkcaldy Gas Company that the clause was inserted in the Burghs Gas Supply (Scotland) Act of 1876, under which the Company were now being purchased. The Act gave the Company the option of being bought up, if the town proposed to start any form of rivalry. In ascertaining the number of years' purchase for a gas undertaking, it had been usual to have regard to the position of the Money Market. He submitted tables showing a comparison of the price of some statutory companies, as between June 1, 1896, and Feb. 19, 1910. The table showed that between these dates there had been a great increase in the percentage of returns—in other words, a great fall in the number of years' purchase. The best class of statutory companies yielded a return which approached 5 per cent. If the yield were 5 per cent., the years' purchase would be just short of 20. It was not reasonable to apply the number of years' purchase obtained for a statutory company to a non-statutory concern. It had always been recognized that there was a difference between them—from three to four years. The table showed that, in the case of statutory companies, the years' purchase varied from below 18 to nearly 24.

Mr. CLYDE: The table justifies the admission that, when such a yield is a little below 5 per cent., and therefore the number of years' purchase was a little more than 20, we get a deduction of three or four years from the standard?

Witness: Yes.

The tribunal adjourned for lunch; and, on resuming,

Witness explained that the difference was affected by taking income-tax into account. His evidence was that the number of years' purchase here should be three or four years below the average of 20½ years for statutory companies brought out in his table.

Cross-examined by Mr. MURRAY: Most of his evidence had no reference to the arrangement of 1845. So far as it had reference, he was of opinion that it was an honourable arrangement. The Company was formed by public-spirited citizens for the benefit of the town.

Mr. MURRAY: In your opinion, does the arrangement of 1845 affect the question of maintainable profit?

Witness: Unquestionably.

Does it affect it in your view because it was a contract which was legally enforceable?—I cannot say. I feel that if I had been a party to the arrangement, I would have been bound to stand by it.

Have you ascertained that the arrangement of 1845 was broken over and over and over again?—Not without quarrel.

Cross-examination continued: In 1861, there was a reconstitution of the contract of co-partnery. To all appearance, the arrangement of 1845 was respected in 1861. The provision to pay 2½ per cent. extra was not in accordance with the arrangement. The essential thing in the arrangement of 1845 was that the dividend should not be more than 7½ per cent. This was the understanding of the people; but they were blinded by the Company.

Mr. MURRAY: So far as the records of the Company are concerned, is there a trace of anyone having ever founded upon the arrangement of 1845?

Witness: I do not know that it was ever founded upon; but if a man makes an honourable agreement, he should stand to it, whether it is complained of or not.

From beginning to end was any attempt made to get the Company to implement the part of the arrangement with reference to the price of gas?—Various attempts were made by the Company to keep up the price of gas, by making allowances and the like, to the deception of the people. My view is that the shareholders having got a 7½ per cent. dividend, the community are not to be mulcted by the Company having been compelled in the past to charge more for gas than any other town in Scotland. Since 1867, the Company have given discounts to the Corporation. This, I suppose, was in respect to the use of the streets.

Is it not the case that, down to 1864, the consumers had the benefit of the large amount of money lying in the business, and that the shareholders were getting no return?—No; the surpluses arose through charging certain prices. The Company could have paid their dividend of 7½ per cent. while charging less than they did. If the Company had had a free hand, and the shareholders had withdrawn the reserve money, the Company could not have carried on their business without an issue of further capital. In that case, there would have been a larger capital upon which to pay dividend.

Does it not come to this, that had it not been that the shareholders allowed the accumulated profits to lie in the business, the Company would again and again have had to increase their capital, as the business expanded? Does not the whole of your criticism depend upon the Company's hands being tied?—Not entirely, because if the people had known that high dividends were being paid, they would undoubtedly have started opposition.

Suppose that the Company's hands were not, in truth, tied, as you suppose, and that they had been limited in dividend, would not this also have resulted in the necessity for an increase of capital, in order to reduce the price of gas?—If you charge a higher price for gas, you will get surpluses, out of which you can extend the works. My view is that the money which went to extend the works was taken out of the consumers' pockets, by charging too much for gas. I do not think that this would lead to a modification of my figures.

What is £4900 of dividend upon £38,353 of subscribed capital?—12·7 per cent.

Have you known statutory gas companies, with a sliding-scale, in which a higher return than this has been allowed?—I believe Bournemouth returns 15 per cent.

So that you have parliamentary authority conferred upon a company which authorizes 2½ per cent. more than the shareholders ever got out of the Kirkcaldy Company?—Quite right.

Cross-examination continued: He had no doubt that the stock of the Company had depreciated. He did not know whether the survey of the mains which he spoke of was an actual survey or a calculation from a plan.

The tribunal then adjourned, to meet in London on a day to be afterwards fixed; the Oversman expressing the desire of the Arbiters and himself that, when they met, they would sit from day to day till they finished the proceedings.

HIGH-PRESSURE GAS SUPPLY IN LONDON.

Six-Inch Mains to be Laid in Subways.

At the meeting of the London County Council to-day, the Highways Committee will report that the Gaslight and Coke Company have applied for permission to lay a 6-inch high-pressure gas-main from the east end of the Strand subway to its junction with the Aldwych subways; also for a short length along the Aldwych north subway, and practically the whole length of the south subway. Acting under the authority given to the Committee in December, they have granted the desired permission on the following conditions: (1) That four days' notice shall be given to the Chief Engineer before the works are commenced; (2) that the point of entry into, and the position to be occupied by the mains in, the subways shall be approved by him, and all works in or about the subways carried out under his supervision; and (3) that any damage that may be done in or about the subways in the execution of the work shall be made good at the sole cost of the Company to the satisfaction of the Chief Engineer. The amount of the rent to be paid by them for the use of the subways has not yet been determined; and the Committee are in negotiation with the Company on the matter.

An interesting lecture was given at the Brentford Gas-Works last Wednesday by Mr. Hankin (of Messrs. William Sugg and Co.). The many and varied productions of the firm were illustrated and described in detail. It may be noted, in connection with Messrs. Sugg, that the Brentford Gas Company have recently fixed many hundreds of their "Regent" lamps.

PUBLIC LIGHTING OF PADDINGTON.

Following closely upon the victory in Chelsea, where the Gaslight and Coke Company have secured a seven-years' contract to light the public thoroughfares, the Paddington Borough Council, after having given full consideration to the question, extending over a period of a year, by three important Committees and after many adjournments in the Council Chamber, decided, last Tuesday, by an almost unanimous vote (35 to 2), to enter into a ten-years' contract with the Company to light the streets of the borough with the newest form of inverted low-pressure burners, for the inclusive price of £11,650 per annum. For this sum the Company will supply new "Nico" lanterns and burners in place of the existing lanterns and upright burners, take over the lighting staff, pay them 1s. per week more than they are now receiving from the Council, and enable them to become, to use the Company's words, "co-partners and profit-sharers."

The details of this long-drawn-out fight between the opposing Companies are familiar to most readers of the "JOURNAL," which has chronicled them *in extenso* during the last six months. It may be stated, however, that in July last both the Works and Finance Committees recommended the acceptance of the Gas Company's very generous offer; the latter Committee having given special consideration to the financial clauses of the proposed contract. In October, it was found that there was a Standing Order requiring consideration of the question by the General Purposes Committee; and this was the occasion and the opportunity to get the whole question reconsidered from the electricians' point of view, especially as the Gas Company's terms were at this time public property. The Committee carefully considered the two new schemes, and reported at great length, and in tabulated form, upon them. The finding of the Borough Surveyor, given after weighing the *pros* and *cons* of the new information, was in favour of the Gas Company's proposals; for he stated "that the sum of £13,000 proposed to be spent by the Gas Company under the head of capital is a reasonable one." In view of this, the General Purposes Committee recommended that, "subject to the consent of the London County Council being obtained to a loan of £13,000 for a period of ten years, in respect of the capital outlay included in the annual cost hereafter mentioned, the Council accept the tender of the Gaslight and Coke Company for lighting the borough, at an annual cost of £11,650 15s., for a period of ten years, with power to determine the contract after the expiration of three years upon payment of one-tenth of the capital sum (viz., £1300) for each year of the unexpired period of ten years.

Then came several adjournments and negotiations between the Chairman of the General Purposes Committee and the Metropolitan Electric Supply Company during the Christmas vacation, culminating in the receipt of a letter from the Company to the Chairman offering fresh terms. This letter was produced to the Council on the 2nd inst., just as the members were about to discuss and vote upon the question. This meant a further adjournment and reference back to the Committee to consider the letter, and interview the two Companies afresh. The Gas Company, however, kept fast to their terms for the lighting of the streets of the whole of the borough; not only refusing to make any reduction, but stating that they would increase their prices if any portion of the lighting was deducted from their scheme, in the following ratio:—

If the total number of lamps is reduced by the substitution of *another illuminant*—

3501 to 4027 lamps	5	per cent. increase
3001 ,, 3500 ,,	7½	,, ,,
2001 ,, 3000 ,,	10	,, ,,
1001 ,, 2000 ,,	15	,, ,,
1000 or under	20	,, ,,

The Electric Supply Company admitted they were in a position to light only a small portion of the borough—the south; and it was stated that in that case it would be necessary to disturb the public ways.

The result of this further reference back was that the General Purposes Committee reported to the Council on the 17th inst. as follows:

> The Council at their last meeting adjourned the further consideration of our report and that of the Finance Committee in regard to the street lighting of the borough, and referred to us the letter from the Metropolitan Electric Supply Company, Limited, of Dec. 30, 1910, asking to be allowed personally to explain their views to us. We have accordingly conferred with a representative of the Metropolitan Electric Supply Company, Limited, in reference to their letter, and have also interviewed a representative of the Gaslight and Coke Company, and, having given the matter our very careful consideration, see no reasons to alter our previous recommendations.

When the report was reached, the Acting-Chairman of the Committee, in the absence of the Chairman (Mr. E. S. M. Perowne), stated that a letter from the Electric Supply Company bearing upon the subject had just been handed to him by the Town Clerk; but, under the circumstances, he suggested that he should not read it to the Council. This course, having been agreed to, the Acting-Chairman stated that his Committee had fully considered the reference from the last Council meeting; and he now formally moved the adoption of their report. Mr. Henwood opposed the motion, chiefly because he did not think the side streets required the additional light proposed by the Gas Company, and considered the term of ten years too long in view of recent developments in lighting. Mr. Waycott also opposed the adoption of the report, not because he did not believe in gas lighting, for he thought it was the best for the streets, but because, in his opinion, ten years was too long a period to contract for. One councillor suggested that the Gas Company should be prepared to reduce the price for lighting concurrently with any reduction in the price of gas that took place.

The Chairman of the Works Committee, in supporting the motion, answered most of the objections raised, and stated that if the Gas Company were not prepared to reduce the lighting terms consequent upon a reduction in the price of gas, they were prepared not to increase the cost of lighting if the price of gas was raised owing to any advance in the price of coal that might take place during the next ten years. With regard to the question of the ten-year contract, it must not be forgotten that the Committee had power to terminate it after the expiration of three years upon payment of one-tenth of the capital sum spent (£1300) for each year of the unexpired term. As to the lighting of the side streets, surely it was necessary, in the interest of public safety as well as of morality, to keep these streets well lighted.

There being no further objections, it was left to the Solicitor to draft a penal clause giving the Council power to terminate the contract in the event of the lighting not being properly maintained. The motion was then put, and carried with the result already stated.

Thus ends one of the keenest fights that have taken place in the Metropolitan area over public lighting contracts—the Gas Company entering into the contest, as usual, with all their cards upon the table, and their opponents enjoying the advantage to this extent.

The fight for the new contracts for lighting the streets of the Metropolis is now nearing its close; and all along the line—that is to say, where there has been *bonâ fide* competition between company and company—the Gas Companies have won, viz.; Southwark, Lambeth, Camberwell, Westminster, Finsbury, Hackney, Bethnal Green, Stoke Newington, Deptford, Woolwich, and Lewisham. Hornsey also holds its own; and Chelsea and now Paddington have to be added to the list. In only three areas have the Gas Company failed to secure contracts—Marylebone, Hampstead, and Shoreditch—each of which has its municipally-owned electric light undertaking, and, therefore, was able to quote at so low a rate as to prevent the Gas Company from obtaining the contract (the ratepayer making up the difference when his demand note came in), or else the low price of the Gas Company was ignored so that the Electricity Committee could feed its concern regardless of cost.

There now remain but three authorities in the Metropolis to complete the list of new lighting contracts, in all of which the Gaslight and Coke Company are interested—viz., the Council of the Royal Borough of Kensington, the Holborn Borough Council, and the Corporation of the City of London. It is fully understood that the first-named Council have referred the matter to their officers; the second are experimenting with the two illuminants in Gower Street; and the City Corporation have delegated the whole question, including the new experimental centrally-hung high-pressure gas lighting, to a Special Sub-Committee for their consideration.

PUBLIC LIGHTING IN WEST LONDON DISTRICTS.

At the last meeting of the Barnes Urban District Council, the Surveyor reported having received a letter from the Brentford Gas Company, suggesting that if the Council would enter into a contract to continue to use gas in the number of lamps at present employed for a period of not less than five years, the Company would take over the maintenance of the lamps for the sum of £2 18s. per lamp per annum, to include the charge for gas, lighting, cleaning, and maintenance; or if the Council would extend the term for a period of ten years, they would alter the existing lanterns to enable them to take inverted burners of the latest type, fit automatic lighting and extinguishing apparatus, and further reduce the price per lamp per annum to £2 15s. The cost of the lamps at present is £3 4s. 10d. per lamp per annum; and the Surveyor stated that the greater portion of the gas-lamps were not in situations in which it was likely they would be altered for electric lighting. The Committee in charge of the matter recommended that the Company be informed that the Council would be willing to enter into a contract for the lighting and maintenance of not less than 200 public lamps for a term of ten years, with an option, subject to six months' notice, of either party being able to terminate the contract at the end of five or seven years, on certain conditions. This was agreed to.

At a recent meeting of the Twickenham District Council, the Lighting Committee reported having considered letters from the Brentford Gas Company and the Twickenham and Teddington Electric Supply Company, Limited, as to the terms upon which they would be prepared to undertake the public lighting of the district. The terms quoted by the Brentford Gas Company included the supply of gas, and the cleaning, maintenance, lighting, and extinguishing of the lamps; and, subject to the Council entering into a contract to continue the use of gas in as many lamps as were at present used for a period of not less than five years, they were only slightly in excess of the present cost, under which the gas is supplied by the Company, and the remainder of the work carried out by the Council. The terms quoted by the Electric Supply Company for lighting the lamps with 100-candle power lamps, including the supply of current, maintenance, &c., were slightly less than the amount at present paid by the Council for lighting the lamps with gas; but for any period less than ten years, the Company would only be prepared to light the portion of the district in which their mains were now laid, and the capital expenditure, estimated at £3 10s. per lamp, would have to be incurred by the Council to cover the cost of connecting-up the lamps with the mains, converting the lanterns, and supplying lamps, fittings, and time-switches. The Committee were of opinion that it would be inadvisable at present to enter into a contract for a lengthy period, and that the best course would be for the Council to invite tenders for the lighting with gas or electricity of the whole or a portion of the public lamps in the district for a period of twelve months. It was decided by the Council that advertisements should be issued inviting tenders for supplying gas or electric current for lighting not being less than 200 lamps for a period of twelve months.

Water Diviner's Success.—With the view of overcoming the difficulty of a shortage of water, the Hornsea Urban District Council some time ago sank a well close to one in existence which was 200 feet deep. After boring 450 feet, only a small supply of water was obtained, and it was brackish. The services of a water diviner were then procured, and he advised boring at a spot half-a-mile from the first well. At a depth of 150 feet, the confluence of five springs was discovered; and it is estimated that the yield will be 100,000 gallons per day.

ACCOUNTS OF GAS UNDERTAKINGS.

This subject was brought before the members of the South Wales and Monmouthshire Branch of the Institute of Municipal Treasurers and Accountants (Incorporated), at a meeting recently held at Cardiff, in a paper by Mr. E. W. Jones, the Deputy-Accountant to the Barry Urban District Council. The chair was occupied by Mr. John Allcock, F.S.A.A., the City Treasurer and Controller of Cardiff, the President of the branch. The paper was as follows.

In submitting for your consideration a paper on the accounts of gas undertakings, I am conscious that many of you are quite familiar with the subject in all its phases, and that any contribution from me will not materially add to your knowledge. At the same time, it is possible that many of the younger members present here to-day are in the service of local authorities who do not own and supply gas. That being so, I am not without hope that my observations will prove of some interest and benefit.

Statutory Authority.

Parliamentary authority for the supply of gas is obtained either by Special Act or by a Provisional Order; and a company may apply for either at their discretion. But whether the former or the latter method be adopted, the provisions of the Gas-Works Clauses Acts, 1847 and 1871, are incorporated.

In order to facilitate the obtaining of parliamentary powers for the supply of gas, the Acts known as the Gas and Water Works Facilities Acts, 1870 and 1873, were passed. Under these Acts, a Provisional Order may be obtained in any district "by any company, companies, or person," therein described as undertakers.

Companies authorized by Parliament acquire, by implication, a regulated monopoly, because so long as they do their duty, within the limits assigned to them, Parliament will not authorize any other company or any local authority to compete with them.

Powers of Local Authorities.

Under the Public Health Act, 1875 (section 161), urban authorities are empowered to contract with any person for the supply of gas for lighting the streets, markets, and other public buildings in their district; and where there is no company authorized to supply gas for public and private purposes, such urban authority may themselves undertake to supply gas for such purposes. This Act also affords an opportunity to urban authorities for acquiring gas undertakings situate within their own districts upon such terms as may be agreed on between such authority and the company, with the sanction of the Local Government Board.

In Scotland, the enactment of the Burghs Gas Supply (Scotland) Act, 1876, confers powers on the local authorities adopting it, which (excluding the City of Edinburgh) admit of every gas company in Scotland being compulsorily purchased on terms settled by arbitration, if not previously agreed.

Form of Accounts.

Under the Gas-Works Clauses Act, 1871, certain forms of accounts, which are in most respects followed by local authorities, are prescribed for the use of gas companies. They are as follows: (*a*) Statement of share capital; (*b*) statement of loan capital; (*c*) capital account; (*d*) revenue account; (*e*) profit and loss account (not revenue); (*f*) reserved fund account; (*g*) statement of coals; (*h*) statement of residual products; (*i*) general balance-sheet.

Space will not permit of *pro formâ* examples of the above being shown in this paper; but I would like to refer you to Schedule B of the report of the Departmental Committee on the Accounts of Local Authorities (1907), which sets out the form of accounts recommended for publication by local authorities.

The laudable efforts of the Council of the Parent Institute with regard to the standardization of forms of accounts are well known to all of us; and in 1908 they prepared, among other forms, those best adapted for gas undertakings. These forms have been submitted to the Board of Trade; and the Council are still awaiting the approval of the Board.

As the capital of gas undertakings is contributed or borrowed for specific purposes, the capital accounts, both of companies and local authorities, are kept on the double-account system, with the object of showing what capital has been raised for the purpose of the undertaking, the amount expended on construction and general equipment (*i.e.*, its cost), and the balance unapplied or over-spent, as the case may be. In order to do this clearly, the balance-sheet is, in effect, divided into two parts—the first, known as the capital account, showing on the credit side the capital receipts from the various sources (*e.g.*, companies; shares, stock, debentures, loans, &c.; local authorities, stock or mortgage loans), as follows:—

In column 1—Amount raised to end of previous year.
" 2—Amount raised during current year.
" 3—Total amount raised.

On the debit side, the capital expenditure (allocated among the various purposes) is shown.

In column 1—Expenditure to end of previous year.
" 2—Expenditure during current year.
" 3—Total expenditure.

The balance of the capital account is carried to the "general balance-sheet," which contains, in addition, the floating assets and liabilities, revenue balances, reserves, &c.

Sources of Income.

The income from gas undertakings is derived from the following sources: (*a*) Ordinary gas consumers; (*b*) casual gas consumers; (*c*) prepayment meter consumers; (*d*) public lighting; (*e*) meter-rents; (*f*) stove-rents; (*g*) fittings; (*h*) residual products; (*i*) other receipts.

Though the method of supplying gas to ordinary consumers and of registering the consumption is well known, there are one or two points of practice that are worthy of mention:—

(1) *Security for Payment of Accounts.*—The owners of gas undertakings have power under the Gas-Works Clauses Act, 1871, before a supply of gas is afforded, to require the consumer to give a security, by way of deposit or otherwise, for payment of accounts; and it is usual, where undertakers have made provision for it in their Special Act, to pay interest on such deposit. This interest is allowed annually by means of deduction from the consumer's gas account.

(2) *Discounts.*—Many local authorities have a system of discounts in operation with the object, primarily, of encouraging the prompt payment of accounts.

In some concerns, the price of gas is uniform, with discount allowances varying according to consumption. For instance, a consumer of 10,000 cubic feet per quarter would be charged (say) 3s. 6d. per 1000 cubic feet, and allowed a discount of 5 per cent. On a consumption of 20,000 cubic feet, an additional 2½ per cent. discount might be obtained; and so on, by increasing the consumption until a maximum discount of 20 per cent. would be allowed to heavy consumers.

Other concerns have a fixed charge for gas supplied, and one rate of discount, whatever the consumption may be.

The arguments advanced in favour of the practice of allowing discount off gas accounts, as against a net charge, are as follows: (1) Consumers pay their accounts promptly; (2) it acts as a "good collector;" (3) the cost of collection is reduced to a minimum, for the accounts are all paid at the office.

It must be clearly understood that discount is not allowed if the account is not paid within a certain fixed time, which is stated on the account. This is rigidly enforced.

Prepayment-Meter Consumers.

The supply of gas by means of prepayment (coin) meters has increased tremendously during recent years, and is a great boon to people who cannot afford to pay an uncertain amount at the end of the quarter for gas consumed. To obtain a pennyworth of gas so conveniently is responsible for the almost total disappearance of the oil-lamp (with its dangers) from thousands of homes in this country.

It is customary in many towns to supply and fix the meter, pipes, and cooking-stove free of charge to the consumer; the price obtained for the gas being arranged so as to cover the rent of stove, meter, and fittings.

The supervision and collection of money from prepayment meters is an important matter; and a good general system of collection and check should be in operation. The following system has been found to work satisfactorily in many towns: (*a*) The cash-collector's district is frequently changed; (*b*) he is never allowed to collect the same district on two consecutive occasions; (*c*) surprise visits are made by an inspector before and after the collector's calls.

Each collector is supplied with a manifold receipt check book. This book shows the readings of the meter, the quantity of gas consumed, and the cash received. The checking of these books is never allowed to get in arrear, and all cash collected is paid in every evening.

To prevent meters in vacant premises being tampered with or robbed, a printed notice is attached to each meter stating: "Consumers must give three clear days' notice before removing from the premises, &c." This enables the meter to be cleared promptly, and before the tenant vacates the premises.

As may well be understood, it is not practicable to collect from slot-meters right up to the last day of the financial year; and there remains when the books are closed a considerable sum uncollected. Although not a general practice, the money uncollected has in one or two towns been estimated on the basis of average consumption, and incorporated in the accounts for the current year.

It may interest you to know that in Barry there are nearly 5000 slot meters in use; the quantity of copper removed from these meters in one year amounting to about 30 tons.

Public Lighting.

To ascertain the quantity of gas consumed by public lamps, many local authorities have adopted what is known as the average-meter indication, whereby uniformity of consumption is secured as between metered and unmetered lamps. This is obtained by fixing meters to a certain proportion of lamps of a like class. For example, suppose meters are fitted to 100 of such lamps, the gas registered by these 100 meters would be totalled and divided by that number, and the result taken as the average consumption for all lamps in the district of that particular class. Having ascertained the correct number of lamps in the district, to arrive at the value of the gas consumed is a simple matter.

On the receipts side of the statutory financial statement which urban district councils have to present to the district auditor, a memorandum must be included of "the net value of gas manufactured by the council and consumed for public lighting in the district." On the expenditure side, this net value must be deducted from the expenditure on gas-works, and included under the separate heading of public lighting.

Meter and Stove Rents.

These rents are included in the same account and collected with the gas-rent; and a separate column is provided for their inclusion in the gas-rental ledger.

It is important that a record should be kept of: (1) New meters and stoves received; (2) old ones brought in from consumers;* (3) issues;* (4) number remaining in stock. In addition, a meter register or meter card should be kept, giving the history of each meter or stove.

Residuals.

The income from residual products consists of coke, breeze, tar, and ammoniacal liquor. It is usual to keep the records as regards residuals both in quantities and sterling. Many gas undertakings also have laid down sulphate plant, which is really a separate trading concern. It is necessary to show the profit on ammonia products separately; and for this purpose care must be exercised to see that the residuals—such as liquor used on the sulphate plant—are debited at a proper rate.

* These should be referenced to meter-state book or rental to ensure that no consumer is omitted from the rental.

Works Cash Sales.

Every gas department receives a proportion of its income from the sale of residuals, fittings, &c., at the works; and it is of critical importance to the accountant to see that these cash sales are properly accounted for. Having regard to the fact that it is difficult to keep reliable records of the exact production of coke and the like, it is obviously difficult to trace that all income from this source is duly recorded. Time will not permit me to detail the system to be adopted —this, in fact, would vary according to the internal arrangements of each works.

Broadly speaking, it may be stated that separate persons should be responsible for the receipt of cash and the weighing of the materials respectively. There are many automatic arrangements in vogue for checking the very numerous supplies of coke in small quantities.

Expenditure.

The expenditure of gas undertakings is mainly divided under the following heads: (*a*) Manufacture of gas; (*b*) distribution of gas; (*c*) management expenses; (*d*) rents, rates, taxes, and insurance—with such subdivisions as may be necessary for the particular concern. As the expenditure does not differ materially, either as to composition or book-keeping treatment, from that of other departments of local authorities, I will not pursue this particular aspect of the subject any further.

Methods of Book-Keeping.

Space will not permit me to set out at any length the detailed methods by which the transactions relative to a gas concern are recorded. I, therefore, content myself with briefly noting the following special features.

Tabular books are employed for recording the rentals; these serving both as journals and ledgers.

The horizontal lines contain the personal account with each consumer, and the vertical columns provide in the aggregate the figures for posting to the credit in the ledger of the gas account, meter-hire account, stoves account, &c.

The rental is usually arranged so that one writing-up of the names will serve for four quarters; and, of late, the practice has become popular of adopting "loose-leaf" methods for gas-rentals—the names, &c., being written on the short removal leaf, which serves for many years, and the particulars of the respective quarter's rentals on the longer sheet, which is renewed as required.

Stores.

The excellent paper given by Mr. Gough, of Tredegar, during our last session, on "Stocks and Stores Accounts," gave a system which practice has proved to be admirably suited for the purposes of gas undertakings. The reading of, and the discussion on, that paper will be fresh in the minds of members; and I, therefore, pass on to mention the following special points which arise in connection with the stores of gas undertakings:—

(*a*) It is necessary at the year end to value the residuals in stock. For this purpose, it is usual to take the market price, though it may be argued that by this method one anticipates profits.
(*b*) It is also necessary to value the coal in stock. This is usually done by measuring the coal, and reducing the measurements by approved formulæ to weight.
(*c*) Coke, &c., used on certain sections of the gas undertaking—*e.g.*, the carburetted water-gas plant—should be debited thereto at an agreed rate.

Fittings.

Where, as is usual, a gas undertaking undertakes the supply of fittings, including the labour incidental thereto, it is necessary to keep a careful record of this work in order that no charges may be omitted.

In up-to-date concerns, it is usual to show the prime cost of each job. The charges for fittings are generally incorporated in the gas-rental in a special column provided for the purpose; and this obviates the need for separate personal ledger accounts.

Loans.

The periods granted by the Local Government Board for sanctions to loans for gas purposes vary according to the life and durability of the subject, and, as a rule, range from ten to thirty years, except in the case of land, where the maximum period of sixty years would be given. If the gas undertaking has been acquired under a Local Act, the loan periods are often greater than those obtained under Provisional Order.

Where sanction to a loan is sought for several objects at the same time—such as meters, stoves, services, fittings, &c.—it is, or was, the practice of the Local Government Board to grant an equated period for the whole loan. This practice of the Board, in giving an equated period for the repayment of a loan, has been with the object mainly of preventing a multiplicity of loans and sinking funds, and often operates unfavourably to a corporation who may be in the position of having to raise a new loan to replace superseded works.

Depreciation and Reserve Funds.

In the form of general balance-sheet given in the schedule to the Gas-Works Clauses Act, 1871, there appears the heading "Depreciation Fund (for Works on Leasehold Lands)." This is the only statutory reference to depreciation in respect of gas-works that I have been able to discover; and this does not in most cases affect local authorities, who are, invariably, the owners of the land on which their undertaking has been erected.

As a matter of fact, local authorities do not appear to have any power to provide definitely for depreciation (other than the compulsory provision for a sinking fund) beyond the amount and scope of the reserve funds permitted by their Local Acts.

The payments out of revenue for the redemption of debt are usually considered to include adequate provision for depreciation; but where an equated period is given in respect of a loan including meters, stoves, slot-fittings, &c., a special fund is necessary to provide for their renewal. The reserve fund, which most local authorities have power to accumulate, usually serves for this purpose.

The establishment of a reserve fund, which Local Acts give power to provide, is quite optional; but a certain sum, or a certain proportion of the aggregate capital expenditure, is usually fixed as the maximum amount which may be applied to this purpose.

Income-Tax.

The profits on gas undertakings for income-tax purposes are assessed under Schedule "A" (but according to the rules of Schedule "D") on the basis of one year's trading, and not on the three years' average, as is the case with electricity and tramways and similar undertakings.

I do not propose to enter fully into the question of income-tax, except to refer to the deductions which should be claimed—viz.:

(*a*) Repairs and renewals of gas meters, cookers, and machinery and plant at works.
(*b*) Payments under Schedule "A."
(*c*) A proportion of the cost of the town clerk's and treasurer's departments, and maintenance of public offices, &c. (if not separately allocated in the accounts).
(*d*) That proportion of the profit which is made out of rate-aided departments, such as public lighting.

As regards the allowances for depreciation of plant and machinery, section 12 of the Customs and Inland Revenue Act, 1878, and section 26 of the Finance Act, 1907, are the authorities dealing herewith; and in 1909, our Institute entered into an arrangement with the Inland Revenue under which for gas purposes no percentage allowance is made for wear and tear, but the actual expenditure on repairs and renewals of plant may be charged in the accounts as incurred. Where the profits for any particular year are insufficient to give effect to the allowance for renewals, the excess renewals may be carried forward as a charge against future profits.

This arrangement is not a statutory one, and is issued solely for the guidance of local commissioners, with whom the determination of the allowance rests.

Some gas authorities have found the arrangement of allowing actual renewals not so favourable to them as the old system of granting a percentage on capital; and the "Financial Circular" for December, 1910, states that three Irish gas companies have successfully appealed against the action of the surveyor of taxes, acting on instructions contained in a circular issued by the Board of Inland Revenue, refusing an allowance for depreciation of plant. In view of the sections of the Acts referred to above, the special commissioners decided that they had no option but to make some allowance for depreciation.

Care should be exercised in dealing with the deductions under the Finance Act, 1907, because the Act authorizes the carrying forward of any part of the legitimate allowance which cannot be deducted in one year by reason of insufficient profits to benefit future years when profits become greater.

Working Statement.

It is very desirable that a working statement should be constructed annually, so that the results of working can be easily compared not only with previous years, but with undertakings in other towns. The following are some of the chief headings in such a statement:—

(*a*) Gas made per ton of coal carbonized.
(*b*) Coke made " " "
(*c*) Tar made " " "
(*d*) Liquor made " " "

The percentage of the working costs is usually calculated on two separate bases:—

(1) Per 1000 cubic feet of gas sold;
(2) Per ton of coal carbonized.

The one basis thus serves as a check to the other.

At the close of the paper,

The President referred to the efforts of the Institute of Municipal Treasurers and Accountants to get the Government Departments to agree to standardized forms of the various accounts of local authorities. He alluded also to the difficulties created in connection with the trading undertakings of corporations by the practice of the Central Authority in granting equated periods for loans, the component parts of which had varying lives. With regard to discounts, the allowance made by some gas concerns was really a trade discount, and partook somewhat of the nature of a differentiation in charge according to consumption. To this there did not appear to be any objection; on the contrary, such difference in charge was, no doubt, justifiable. But with respect to purely cash discounts, he thought it was open to question whether they did not operate rather unfairly to the poorer classes of the community.

Other members having offered remarks on the paper, the author was accorded a hearty vote of thanks—his communication being characterized by the President as "most interesting and practical."

Water-Rate for Trade Purposes.—The Managing-Director of Colley's Patents, Limited, is appealing to the public for pecuniary assistance to enable them to contest in the Court of Appeal, and, if necessary, in the House of Lords, the claim made by the Metropolitan Water Board to charge at the "domestic" rate for water supplied to them in connection with their workpeople. They consider that other traders are equally interested with themselves in having this question settled; and they think they ought not to have to bear the whole of the attendant expense.

Portsmouth Water-Works Assessment.—A deputation from the Portsmouth Water Company, headed by Mr. W. Grant, the Chairman, waited upon the Portsmouth Assessment Committee last Wednesday to appeal against the new assessment of their property. It was pointed out that in 1905 the assessment agreed upon was £20,900 gross and £15,400 net; but the Committee now proposed to raise the amounts to £22,860 and £18,290 respectively. It was stated that in the meantime there had been but a very small increase in the mains for improving the service; while the pecuniary gain had been no more than 9·9 per cent. The valuation list was confirmed by the Committee; and the result will probably be that, should further negotiations fail, there will be an appeal at the Quarter Sessions.

AUTOMATIC LIGHTING AT LIVERPOOL.

At a meeting last week of the Liverpool City Council, some discussion took place on the estimates of the Lighting Sub-Committee, in the course of which the automatic lighting of street-lamps was referred to.

Mr. MAX MUSPRATT said he thought it desirable that they should be provided with some information in regard to these estimates. There had been a policy adopted during the last two or three years which had promised a great reduction. Unfortunately, this reduction was not very apparent; and seeing the large amount of money which had been expended upon automatic street lighting, he would like to know what had become of the promised savings. The amount expended upon gas in 1909 and 1910 had been the same each year, in spite of the fact that they had already started automatic street lighting. In 1911, the estimates showed a reduction of only about £600. Here he wished to remind them that the price of gas was reduced last July by 1d. per 1000 cubic feet—about a thirtieth of the total—and this item alone meant a reduction of £700. But there was to be a further reduction to the extent of 2d. per 1000 cubic feet from the beginning of April next, and this would mean a saving of £1400; so that, compared with 1909, there should be a total reduction of £2100 in the price of gas, providing there were no extensions. Of course, they all knew every year there was certain extension; but having regard to competition in respect to electric lighting, and the considerable extension of the use of electric light by the Lighting Committee itself, he for one did not think that anything approaching a 10 per cent. increase was likely to occur during the present year as compared with the last two years. At any rate, this matter of a saving of £2000 needed some explaining; for it would appear that it had entirely disappeared in the general morass of the Committee's figures. He thought he was right in saying that the automatic lighting started two years ago upon something approaching a large scale; and it was decided that it should be distributed over about four years, so that the expenditure, amounting to something like £16,000, should not be too heavy a charge in any particular year. Two years had now elapsed; and the promised saving had not yet made its appearance in the estimates. Furthermore, the reduction of wages which it was said would accrue as a result of automatic lighting was nothing like the saving promised. He also wished to know if any workmen had been displaced; and, if so, whether they had been found employment in other departments of the Corporation.

Sir CHARLES PETRIE, in reply, pointed out that from 1908 up to the present time, and included in the estimates for the present year, there had been a reduction in wages to the extent of £1174. This was entirely due to the new process of lighting the lamps automatically. Some three or four years ago, the Lighting Committee came forward with a proposal to spend £35,000 or £36,000 on automatic lighting. He opposed the recommendation, and urged that it was better that they should proceed cautiously. They were shown that the new system would result in a very large saving in wages. The Committee had proceeded cautiously during the last two or three years in regard to putting up the automatic lighters; and they had been careful not to dismiss any men right away, because they had felt at the time that if they had adopted the full policy of spending this large sum of money, it would of necessity have meant dismissing a great number of employees. The policy they adopted was not to dismiss men, but not to replace them when they happened to fall out. The consequence had been that they had been able in this way to bring about the reduction in wages he had mentioned. In regard to the price of gas for the ensuing year, this matter had been taken into careful consideration. He found that in the present estimates there was a reduction of some £620 compared with the actual expenditure of 1910. The reduction in the price of gas of 1d. per 1000 cubic feet in July last, and the prospective decrease of 2d., reduced the gas bill to the extent of £1200. But they had to take into account the increase of £475 for extra gas consumed by lamps which were formerly extinguished at midnight, and which now remained burning all night. Then, again, the number of streets in Liverpool which had to be lighted was largely increasing every year; and it was only by economic management, and by the installing of automatic lighting appliances, that they were able to keep anywhere near the estimates of former years compared with the present time. As it was, the estimates compared very favourably; but were it not for their economical management, no doubt the price of lighting would mean an increase to the city of several thousand pounds per annum more than at the present time.

Mr. BOOTE said if Mr. Muspratt had attended the Committee, he would have got to know that these automatic lighters, which were put down in the estimates at a cost of £4000, could not come out of capital account, but had to come out of the rates. Had they made the full charge on the rates at once, it would have been a serious matter.

Alderman DART said the Council and the general public owed a debt of gratitude to the Lighting Committee. It was owing to the action of the Deputy-Chairman of the Committee that a saving of £7000 a year was effected in the lighting of the streets when the Corporation took over the lighting from the Gas Company. An enormous saving was also effected when the incandescent burners were introduced. Instead of borrowing large sums of money, the Committee paid for things as they went on. In a few years, there would be a very large saving to the community; but it was unreasonable to expect this at present, because the cost of providing new means of lighting was being met.

Alderman DUNCAN said that, in order to light the city by these automatic controllers, they would require 19,000. Up to the present, they had only received 2330, because the Committee wished to get them gradually. Of this number, only 1000 had been actually in operation. It would take a few years before there was any marked saving in the amount of wages. He was glad to notice that there was an increase in respect to the amount of gas consumed, which had been brought about by discontinuing in many instances the practice of turning the gas off at midnight. Whenever applications had been made for the continuance of lighting after midnight, the Committee had acceded to them.

Mr. J. WILSON WALKER said his father, the Chairman of the Lighting Sub-Committee, was not able to be present; but he wished him to say that, in spite of the additional lamps erected in the city, the cost for lighting and the expenditure in wages were slowly but surely decreasing. This was due to the introduction of the automatic lighter. The saving estimated on each automatic lighter in use had so far been realized; and they might expect very good financial results when the whole city was equipped with the apparatus.

Alderman BROWNBILL remarked that complaints had recently come before the Finance Committee to the effect that Liverpool was "overgassed." He meant that there was more gas lighting than was necessary. He charged the Committee with extravagance. There had been extravagance in lighting in the small hours of the morning. The Committee had lighted a great many back passages; and this he thought was not necessary all night. People did not want to go round back passages at night.

Sir CHARLES PETRIE said the decision to light the back passages and courts was arrived at some years ago by the Council; and he was very glad that they had acted upon it. In regard to the lighting of these passages, there had been a dispute between the Gas Company and the Corporation. The Company claimed between £6000 and £7000 for laying the gas-pipes to these back passages and courts; and after a considerable amount of negotiation, they had settled the matter by agreeing to pay the Company 50 per cent. of their claim. The Gas Company had agreed to receive the £3000 in yearly instalments of £1000; and only one instalment was included in the estimates for the next year. The Company had met the Corporation very fairly in the matter.

The estimates were approved.

SALFORD METER-RENT CHARGES.

At their last meeting, the Salford Gas Committee decided to recommend the Council to refund the money which had been paid on the September quarter accounts by gas consumers as meter-rent, and that on the next accounts sent out allowances be made accordingly.

It will be remembered that in June of last year the Council adopted a resolution authorizing the Gas Committee to re-impose meter-rents and to reduce the quantity of gas supplied for a penny to slot-meter users from 30 to 27 cubic feet; these changes being due to the calls made upon the Gas Department for grants out of profits in relief of rates, and the increased price to be paid for coal during the current year. Public feeling, however, was so strong in regard to the meter-rents that in October last the Council decided, without one single member dissenting, to abolish the charges as from Sept. 29; and the following month a resolution was carried by 24 votes to 10 that the price of gas be increased by 2d. per 1000 cubic feet to all consumers except slot-meter users, as from Dec. 31, 1910. In the meantime, the right of the Corporation to charge meter-rents was raised in the Police Court—Mr. James W. Cooke, the Chairman of the Salford Ratepayers' Association, being summoned for the non-payment of his gas account, which included 1s. 6d. for meter-rent. The Magistrates decided that the defendant was only called upon to pay for the gas that he had consumed, and made an order accordingly. Notice of appeal was given by the Corporation. Following this, many consumers refused to pay their bills with the meter-rent included. As the majority, however, had paid their accounts, the Gas Committee found themselves in a difficulty; and as the legality of the charge had been challenged, some members considered it advisable to again review the position. This was done last week, when the Committee resolved to refund to consumers who had paid the meter-rent the amount so charged.

A member of the Gas Committee, being asked if the legal position of the matter was responsible for the Committee's decision, replied in the negative. He and others in favour of the refunding of the charges were, he said, actuated by other considerations. "There is a law of the land, and there is also the moral law," he added; "and as the Council would have been put in a peculiar position if they had tried to secure payment of a number of ninepences and one-and-sixpences in the Courts, it was thought better, on moral grounds, to return the rent charges to those who had played the part of good citizens, and met the obligations which the Council deemed fit to impose."

The Committee's decision, which will involve a considerable amount of clerical work, will be brought forward for approval at the next meeting of the Council. Mr. Purcell, one of the Labour members, has also intimated his intention of submitting a further resolution with a view to securing a return to the old order by giving 30 cubic feet for a penny to consumers by slot-meter.

MARGAM DISTRICT COUNCIL BILL.

Opposition by Ratepayers.

A public meeting of the ratepayers in the area of the Margam Urban District Council was held at the Central School, Port Talbot, last Thursday, for the purpose of obtaining their sanction to a Bill which the Council are promoting with the object of purchasing from the Aberavon Corporation parliamentary rights to light the district with gas. In the proposed Bill, which was noticed last week (p. 153), the promoters ask for power to borrow £27,000 for the purchase of a site and erection of gas-works in Port Talbot.

Major Gray, who presided, said that in 1884 the Aberavon Corporation secured parliamentary authority to light Margam parish, but the present conditions of lighting in the district were intolerable with a population of 13,000; and he believed that in another five years the population would increase to 20,000. Mr. D. E. Jones, the Clerk to the Council, having explained the objects of the Bill, the Chairman proposed a resolution that the meeting approve of the Council's application. This having been seconded, Messrs. W. Davies, C. Lewis, and Jonah Thomas strongly opposed the Bill; the last (a member of the Council) pointing out that the Parliamentary Agents had advised the Council not to go in for their own lighting power, and suggested

the formation of a Joint Board with Aberavon on the gas-works question. If this were done, it would give Margam in time a share in the Aberavon Gas-Works and the profits from them.

Other speakers opposed the Bill amid considerable uproar. Eventually, in a scene of great disorder, a vote was called for. A show of hands was in favour of the resolution; but the majority included a number of youths, and some held up both hands. It being utterly impossible to check the vote properly, the Chairman declared the resolution carried; whereupon a poll was demanded and agreed to.

WINCHESTER CORPORATION AND ELECTRIC LIGHTING.

Proposed Purchase of the Local Undertaking.

The ratepayers of Winchester had before them in the week ended the 14th inst., the important question of the proposed purchase by the Corporation of the undertaking of the Electric Light and Power Company, for sanction to which authority will be sought next session.

The first expression of public opinion was made at a meeting of the Ratepayers' Association held on the 10th inst. But it cannot be said that it was very enthusiastic; for at the opening of the proceedings there were only five or six people in the room, and there were not more than twenty throughout the evening. It was explained by Mr. Symes, a member of the City Council, that a Special Committee of the Corporation approached the Electric Light Company, and gave notice of purchase. They could not at first agree as to price; but after a time negotiations commenced, and an agreement was come to. The purchase price should have been £99,731—representing the capital expended, *plus* 10 per cent.; but, as the result of the negotiations, it was agreed that it should be £91,000—a drop of nearly £9000. According to the table of profits set out in the Committee's report, it was calculated that in the current six months there should be a profit made of £1166, which ought to be more than sufficient to pay all the expenses of carrying the proposed Bill through Parliament. He hoped the matter would be looked upon from a strictly business point of view; and the Committee trusted that the purchase would in the future result in benefit to the ratepayers, not only in the price charged for electricity but in a reduction of the rates. After some remarks, the following motion was carried *nem. con.*: "That we as a meeting of ratepayers desire to express our satisfaction with the way in which the Committee of the Council have carried out the negotiations for the acquisition of the Winchester electric light undertaking, and they have our confidence in the steps they have taken."

A special meeting of the City Council was held the following Thursday morning, to receive the report of the Committee referred to by Mr. Symes at the meeting of the Ratepayers' Association. In the course of the report, the Committee said that, having been advised by their expert engineer that the electricity works and plant were in good order and condition, their negotiations with the Electric Light Company resulted in an agreement being reached that the Corporation would pay £91,000 for the undertaking as at the 30th of June last, *plus* the sum actually and necessarily spent on capital account between that date and the 31st of December. The Company will work the undertaking for the benefit of the Corporation until the latter are in a position to do so themselves, which it is expected will be in about six months' time. Meanwhile the Company are to receive 5 per cent. on the amount of the purchase-money; the balance of the profits going to the Corporation. The Committee said they regarded the settlement as favourable for the Corporation; and they expressed the opinion that if they obtained only 30 years, instead of the 45 years asked for in the Bill, in which to repay the loan capital, there would be a margin of 2 per cent. of disposable profits, which, on a capital of £91,000, would be equal to £1820. Mr. F. W. King moved the adoption of the report, which, after a long discussion, was carried with one dissentient.

In the evening, the statutory meeting of ratepayers was held in the Guildhall, under the presidency of the Mayor (Mr. J. S. Furley). Mr. King, at the close of a long speech, moved a resolution approving of the Council's application to Parliament. It was duly seconded by Mr. Edmeades, who explained that, with one exception, the Council were unanimous in their support of the proposal to acquire the electric light undertaking. Mr. Percy Snelling criticized at some length the action of the Council. He pointed out that during the past five years the Electric Light Company had made an average profit of about £6500 a year, and had arrived at this profit without deducting a farthing for depreciation. The capital of £90,000 had been expended on plant, machinery, cables, and so forth, all of which was material of a depreciative nature. If the plant and machinery did not wear out, it became obsolete. The £6500 might be a perfectly accurate estimate of the profit, and all right for the Company if they chose to do it with their own money. If the Corporation purchased the undertaking, they would be bound to provide a proper and sufficient depreciation fund to meet wear and tear; and if they did this, he submitted that all chance of even paying their way was absolutely gone. The Company were not by any means willing sellers; and if it was the wish of the meeting, he believed the contract could be easily cancelled. He therefore moved: "That this meeting be adjourned for seven days in order that the Corporation, with the assistance of three ratepayers to be chosen by the city, should negotiate with the Electric Light Company with a view to obtaining a withdrawal of the notice to purchase and to report thereon." The Mayor said that a motion for an adjournment rested entirely on the discretion of the Chairman; and he declined to accept it. Mr. Arnold Tebbutt also spoke against the purchase. He said he did not believe that the electricity undertaking, if acquired by the Corporation on the terms proposed, could be a success. Even under the utmost economical management, it would mean a loss to the ratepayers. It was either a bad bargain for the Corporation and a good one for the Company, or a bad one for the Company and a good one for the Corporation. If it was a bad one for the Company, they would be willing to tear up the agreement. If it was good for them and bad for the Corporation, they would say they would not let the Corporation off without paying something. If it was a bad bargain, let the Corporation get out of it with the first loss, which would be the cheapest. The Mayor, in closing the discussion, said that though, as a shareholder in the Company, he stood to lose personally by the transfer of the undertaking to the Corporation, he was very strongly in favour of it, as he believed it would be a permanent benefit to the city. He then put Mr. King's motion, and declared it carried; the announcement being received with applause.

THE PROPOSED RESERVOIRS IN THE THAMES VALLEY.

Opposition to the Metropolitan Water Board Scheme.

The Town Clerk of Windsor (Mr. E. C. Durant), acting upon instructions received from the Town Council, recently convened a conference of representatives of Local Authorities interested in the scheme of the Metropolitan Water Board for the construction of water reservoirs in the Thames Valley, for which they will seek parliamentary sanction; and the meeting was held a few days ago in the Guildhall, Windsor, under the presidency of the Mayor (Mr. C. F. Dyson). There were present the Mayor and Town Clerk of Maidenhead, and representatives of the Buckinghamshire County Council and of the following Councils: Windsor Rural, Eton Urban, Eton Rural, Cookham Rural, Marlow Urban, Staines Urban, Datchet Parish, Old Windsor Parish, Wraysbury Parish, Clewer Parish, and Taplow Parish.

In opening the proceedings, the Chairman explained the scheme of the Water Board, and exhibited a plan prepared by Mr. V. Buckland showing how the proposed reservoirs could be conveniently placed farther from the river, at Stanwell, near the Hounslow Road and the existing Staines reservoirs. In this position they would not, he said, do harm to the Thames Valley. Mr. Burstall, M.Inst.C.E., who stated that he had been instructed to represent the London and South-Western Railway Company in the controversy, gave an exhaustive description of the position, and pointed to the fact that the proposed reservoirs would not only hold up flood water, but would cover a large piece of land through which, at present, a vast amount of flood water escaped by percolation. Mr. Burstall having been complimented upon his exposition of the situation, the Chairman submitted the following resolution: "That this meeting, having carefully considered the plans showing the position of the reservoirs proposed to be constructed by the Metropolitan Water Board, urges upon the various councils here represented to consider the advisability of opposing the Bill as now introduced, on the ground that serious obstruction will be caused to the flow of water in time of flood, thereby endangering riverside property and the health of those living within the flooded area; and that every endeavour be made to compel the Metropolitan Water Board to construct any reservoirs at such distance from the main river as will allow of a free passage of water, as at present, through the subsoil in the valley gravel." The resolution was carried unanimously; and it was decided that a copy should be sent to the Thames Conservancy Board.

The Datchet Local Authorites have met and have passed a resolution to the effect that, after a careful examination of the Water Board's plans, they have come to the conclusion that the proposed works would be objectionable, as certain "seriously to increase the flooding of the Thames Valley, to impede the escape of flood water, and to depreciate the value of property along the river."

The Buckinghamshire County Council have also had the matter under consideration through their Parliamentary Committee; and it has been decided to offer the most strenuous opposition to the proposed works as at present designed; while representatives of some of the minor districts have agreed to go over the portions which will be affected by the Bill, and afterwards to meet at Aylesbury and formulate a plan of opposition.

Fatal Fall into a Sulphate of Ammonia Tank.

A gas-fitter named Ezra Higgs, employed by Messrs. Crossley Bros., of Manchester, fell into a tank containing a weak solution of sulphate of ammonia, while following his employment; and before assistance could be obtained, he was so badly scalded that he died the same evening at the Royal Infirmary. At the inquest, Mr. F. Brighton, the chemist at the works, said that the tank contained about 600 gallons of liquor, the temperature of which might be 60° C. (140° Fahr.) at the time of the accident; and the percentage of sulphuric acid was 0·1. The tank had an open top, and across it were two planks used by workmen for getting to a valve above. In reply to the Coroner, the witness said it was not possible for gas to have escaped from this valve. A police constable who took Higgs to the Infirmary said that the man's own story was that he was walking along the planks to get to the valve when he thought he got a mouthful of gas, and so fell into the tank. Higgs was, however, in great pain, and did not seem quite definite as to how the accident happened. The Coroner having suggested that it was the temperature of the liquor and not its chemical composition which caused the injuries from which Higgs died, the Jury returned a verdict of "Accidental death," but expressed the opinion that men working at these tanks should be afforded better protection.

Opposition to the Bedwellty Urban District Council Bill.—Three memorials complaining of non-compliance with Standing Orders have been presented in connection with the Bill of the Bedwellty Urban District Council; among the memorialists being the Blackwood Gas Company. It is alleged that the parliamentary notices did not indicate sufficiently the intention of the Council to supply water and gas, or the limits proposed to be served; nor did they state the intention of the Council to raise the rates at present charged by the New Tredegar Gas and Water Company, Limited, as proposed by clause 14 in the Bill. The memorialists also complain of the insufficiency of the notices in regard to the clause relating to the taking of land; and also to the one giving power to the District Council to acquire by agreement the undertaking of the Blackwood Gas Company, Limited.

WORKSOP WATER PURCHASE ARBITRATION.

First Day's Proceedings.

As was briefly recorded in last week's "JOURNAL," an arbitration has been held at the Surveyors' Institution, Great George Street, Westminster, to determine the price to be paid by the Worksop Urban District Council for the undertaking of the Worksop Water Company, under the Act sanctioning the purchase which was obtained by the Council last year. The proceedings, which commenced on Tuesday, the 10th inst., extended over five days.

The Arbitrators were Mr. FRED FOWLER, for the Water Company, and Mr. EDWARD WILLCOX for the Urban District Council. Mr. A. J. RAM, K.C., acted as Umpire.

Mr. E. HONORATUS LLOYD, K.C., and Mr. H. COURTHOPE MUNROE (instructed by Messrs. Sherwood) appeared for the Company; while Mr. A. WEDDERBURN, K.C., and Mr. F. KEEN (instructed by Messrs. Baker and Co.) represented the Council.

THE CASE FOR THE COMPANY.

Mr. HONORATUS LLOYD, in opening, sketched the history of the undertaking, which, he said, was formed under an Act of 1875, with a capital of £12,000 in 1200 shares of £10 each. The well then authorized by Parliament was sunk; and the works were opened in 1878. Then in 1885 a second well was sunk, which was connected with well No. 1 by a heading. As time went on, there was an increase again in the customers; and in 1907 a third well was sunk, in close proximity to the others, though not upon land which had been acquired compulsorily under the Act of 1875, but on a piece of land which had been purchased under the lands-by-agreement clause. Therefore it was doubtful whether or no the Company were authorized in sinking this well. However, even then the Company had not sufficient water; and they acquired, also under the lands-by-agreement powers, land some little distance away, known as the Checker House site, with a view of sinking a well upon it. In 1909, the Company came to Parliament for authority to sink this well; and they also sought confirmation (as did many other companies at the same time) of well No. 3 which they had sunk upon their agreement lands. Further, they said that it might be doubtful whether they had not exceeded their powers in sinking No. 2 well, inasmuch as the 1875 Act had spoken of "a well," and they had sunk the other one within 140 feet on their compulsory land. Therefore they said to Parliament, "Authorize Checker House, confirm No. 3; and as we are also in some doubt, or may be, as to No. 2, confirm that too." However, subsequently it was found that the suction-pipe in No. 1 well was very faulty; and that the bucket had never been properly fixed in No. 3 well. These things were put right; and ever since then there had been an ample supply of water. No one opposed the confirmation of wells Nos. 2 and 3; but the Checker House site was not authorized—an agreement being entered into instead with the Manton Colliery for a supply of perfectly pure water which was then being pumped to waste by them. In the 1909 Act, on opposition by the Council, a clause—section 15 (1)—was included to the effect that, if the Council should introduce a Bill in the next available session for the purchase of the undertaking, the Company should not oppose it, except to secure the insertion of clauses to protect their interests. The section continued: "If such Bill receives the Royal Assent, nothing in this Act shall authorize the Company for the purpose of the determination of the purchase price to be paid for the said undertaking to bring into account, or to make any claim in respect of, any powers, rights, or advantages conferred on them by, or resulting from, the passing of this Act. The Company shall not, except with the consent of the Council, raise any capital in pursuance of this Act prior to Nov. 20, 1909; and if the Council shall give notice for such Bill as aforesaid in October or November, 1909, the Company shall not raise any capital in pursuance of this Act during the promotion of such Bill, save what is necessary for carrying on the undertaking and works to be done under this Act and satisfying existing obligations." There was at that time a substantial sum of money still unraised under a prior Order; and this prohibition against raising capital pending a Purchase Bill did not in any way affect the past capital. The following year the Council promoted a Bill to acquire the undertaking by agreement or by arbitration under the Lands Clauses Acts; and hence the present proceedings. It was stipulated that the Company should be considered as vendors by agreement, and not by compulsion; and that the Council should pay the Company's taxed costs in the arbitration. He was bound to say that, under the circumstances, it seemed to him a little hard that the Company were to have no allowance whatever for compulsory purchase, having regard to the fact that they were dealing with a Local Authority whose one fear when the Company was started had been that the undertaking might be foisted upon them—they being the most unwilling people in the world to have it. All stock-in-trade, coal, and other stores belonging to the Company at the date of transfer (which it had been assumed would be June 23) were to be taken at a valuation; and all debts were to be satisfied by the Company. The Council remained quiet so long as the Company were doing their work under hard straits for money, and were paying no dividend. The Company were now, however, paying their maximum dividends, and, in addition, were earning very considerable profits which they were applying to the payment of back-dividends. The Accountants on both sides had met, and agreed upon the usual form of financial tables. In addition to the Acts he had referred to, there were, of course, several Orders relating to capital powers. Coming to the Company's claim, the first item was for the capitalization of the maximum dividends. These dividends amounted to £1944; and they were so amply secured that they ought to be capitalized on the 3 per cent. table, which would give a figure of £64,800, Then the amount of back-dividends outstanding was £8359; and it was calculated that at June there would be sufficient surplus profit to reduce this to £6655; and to arrive at the present value, they discounted on the 3 per cent. table, Calculating that by June 30, 1920, they would have paid off the whole of these dividends, the cash value of the amount to-day was £5822. Next there was the mortgage debt of £4250, *plus* a claim of six months' interest in lieu of notice to the mortgagees, which came to £92 10s.; and there was also a claim (after making certain deductions) of £6796 12s. 10s. for over-spent capital. Of course, out of the unexhausted powers the Company might have raised this capital, and paid dividends on it; so it would be monstrous to leave the Company to pay off the excess capital. For loss of interest pending re-investment, brokerage, and so on, a sum of 2 per cent. on the first item of £64,800, amounting to £1296, was claimed. This made a total of £83,057 2s. 10d.

Mr. *William G. Hawson*, Auditor of the Company's accounts, said that from his intimate knowledge of the undertaking he was able to state that it was in a sound position. In the accounts there was no figure for depreciation, except for meters and office furniture. It had never been considered necessary to allow anything for general depreciation of the works.

Mr. *William Allen* said he had been Chairman since the formation of the Company in 1875. Prior to that time the town of Worksop was in a very insanitary state as regarded water. The town could not have developed as it had done, but for the water-works. In 1892, the Company began to pay their full 10 per cent.

Mr. WEDDERBURN (in cross-examination): Thoroughly sound water companies, in which any Worksop man paid off can invest, yield 4 per cent. and over. Why should you ask to be given such an amount as will enable you to get your existing income in a 3 per cent. security? Do you not see that it is ¼ per cent. better than Consols? Even Consols are not good enough for you.

Witness: I think I am right in saying that, if we can get the amount claimed, it would be fair.

Mr. *William Cash*, of Messrs. Cash, Stone, and Co., said that he thought the Company were entitled, notwithstanding the provisions of the Act that they should discharge the liabilities, to ask the Council to refund to them the amount of their over-spent capital. He adopted for the basis of his figures the set of tables agreed upon between the parties. For the purpose of preparing an adjusted revenue account, he had taken for water-rates, meter supplies, public supplies, and meter-rents, the year 1910; but for supplies for building, &c., an average of six years had been adopted. The result arrived at was a maintainable income of £3147 8s. 2d., which, after payment of dividends and interest, would leave a surplus available for payment of back-dividends on the adjusted year of £815 18s. 2d., so that the maximum dividends would appear to be amply secured so far as finance was concerned, provided there was a sufficiency of water, and the works were in a good state of repair. If his view was adopted with regard to the repayment to the Company of the over-spent capital, this would, in addition, release to them the balance of the undivided profit, which he put at £888; so that at June 30 he reckoned there would be a surplus of £1704 available, which would have to be deducted from the total sum due for back-dividends, leaving £5822.

Mr. *E. M. Eaton*, M.Inst.C.E., described the wells and machinery, and stated that the undertaking was in good general condition. On the whole there had been a steady growth in the revenue; and there was no doubt whatever that if the Company had been allowed to go on, this state of affairs would have continued. In drawing up a revenue account, he had, with certain adjustments, arrived at an income of £5247 12s. 2d., and an expenditure of £2100 4s.—leaving a balance of £3147 8s. 2d. as the maintainable income. In consequence of the great security of this class of investment, he asked for 33⅓ years' purchase of the maximum dividend (£1944), which would give £64,800. The amount for back-dividends, discounted on the 3 per cent. table, he and Mr. Cash had agreed at £5822. It was not unreasonable to ask the Council to pay six months' interest, in lieu of notice, on the mortgage debt. He agreed with Mr. Cash on the question of over-spent capital. The 2 per cent. for loss of interest pending re-investment, &c., brought the total amount of the claim to £83,057 2s. 10d. If this had been a claim made in the ordinary way for the full value of the net maintainable income, and no question of limitation of maximum dividend had been involved in it, he would have made certain deductions for work which might require to be carried out; but as they were handing over after nine years (the period during which the amount for back-dividends would be earned) £815 a year in perpetuity, this would be available for any purpose to which the Council might wish to apply it. Therefore he declined to admit a suggestion that the Company should find anything to enable the Council to improve the works, when they would be handing over this balance of revenue to enable them to do it themselves.

Cross-examined: For the purposes of the present supply, and even for an additional population, the Council would be able, without any extensions, to rely on wells Nos. 1, 2, and 3. The consumption had been over 360,000 gallons a day; and the wells had easily met the demand.

Second Day.

Mr. *Eaton*, in further cross-examination, denied that every year all well-conducted water companies put aside a substantial sum for depreciation. The Company did allow depreciation for meters and office furniture; but these were two items too many. There ought to be no allowance whatever for depreciation. For the use of the existing consumers, he did not think it was necessary to have another reservoir. The pressure was very good all over the district. The new offices which had been built were not beyond the necessities of the Company. They were erected, not for the work of the Company in the account year, but for the future development of the concern.

Mr. *George Heaps*, Secretary and Manager of the Company, said he was appointed in 1897, and recollected the time when they were short of water. After going to Parliament in 1909, however, they obtained more water from the existing wells, in consequence of some alterations to the suction-pipe of No. 1 well and the bucket of No. 3 well. Since these matters were put right, he had been able to supply the whole of the district without any difficulty. The alterations were made in February and August, 1910.

Cross-examined: He could not say what amount of water was obtained from well No. 3, as he had no means of measuring it. There were two Venturi meters which showed the supply on the north and

south sides of the town; but the water which they registered came from all three wells.

Mr. WEDDERBURN: Why did you keep back the fact of this alteration in the suction and the subsequent alteration to the bucket until yesterday?

Mr. HONORATUS LLOYD: He told Mr. Eaton in October.

Mr. WEDDERBURN: Why did you keep it back from the Council, as you unquestionably did, until yesterday?

Witness: It was no business of theirs.

Mr. WEDDERBURN: All I can say is it seems to me to be as unfrank a thing as possible for the Company to have done.

Mr. *William Terry*, the General Manager of the Sheffield Corporation Water Department, said he had been frequently consulted by the Worksop Company. In 1909, he gave evidence for them in connection with their application to Parliament; and at that time he believed it was necessary they should make immediate provision for the future. Subsequently, he found they were not in straits for water; and the alterations already explained came to his knowledge. This discovery resulted from an inquiry as to the cause of fluctuations in the coal consumption. The deficient supply in 1908 was evidently due to the constructional defects in the pumps. Now, from all appearances wells Nos. 1, 2, and 3 were capable of yielding a very much larger quantity of water than the amount at present supplied. He had heard no suggestion of complaint either as to the quality or the quantity of the water; and he believed it to be an excellent water for a general supply. The whole of the works had been thoroughly maintained, and were in excellent order. Financially the undertaking was very strong. After payment of the maximum dividend and mortgage interest, there was an available surplus amounting to 26 per cent. of the total maintainable income. He agreed with Mr. Eaton that the purchase should be on a 3 per cent. basis, and also as to the figures generally that he had put in. In fact, the statement was prepared by them in conference.

Cross-examined: When Mr. Diggle visited the pumping-station in October, he was informed by witness that the yield of No. 3 well had exceeded the anticipations of everybody, though he (Mr. Terry) did not then know exactly what the reason was. If he had seen Mr. Diggle after he had found out about the alterations made, he would have told him of what had been done.

The UMPIRE (to Mr. Wedderburn): Are you going to ask the tribunal to say as a fact that this information which subsequently came to Mr. Terry's knowledge, after he had seen Mr. Diggle, as to the connection between the two wells, and as to the repair of the bucket, and was not divulged to Mr. Diggle or to the Council in any way, financially affects the value of the undertaking or the price we ought to award?

Mr. WEDDERBURN: No; but I am going to say that it puts the Water Company in the position of having to give you very strict proof of what they allege.

Mr. HONORATUS LLOYD announced that this was the case for the Company.

THE CASE FOR THE COUNCIL.

Mr. *James Diggle*, M.Inst.C.E., said he had made several inspections of the district; but he had been unable to get from the Company much of the information which was necessary to enable him to fix the true value of the undertaking. He had not heard until the previous day about the bucket and suction-pipe alterations. When at the works in October, Mr. Terry told him he would state at the arbitration that he had no regard whatever to anything obtained from No. 3 well in the calculations for his evidence on the 1909 Bill.

Mr. WEDDERBURN: The tribunal have to make up their minds as to what the capacity of the wells is, and what risk there is to the Council with regard to any failure of supply in any dry year. The difficulty I feel is that no test over a single day could be a very sound one; but if there is any kind of test which would be satisfactory and can be made before you give your award, I should like it to be taken.

Mr. HONORATUS LLOYD: I place no obstacle in the way of any test which can be conceived.

The UMPIRE: After the hearing, I shall ask the advice of my colleagues as to whether they think there is sufficient evidence to enable us to arrive at a proper determination; and, if not, what test they would advise.

Third Day.

Mr. *Diggle*, further examined, said it was quite impossible to treat an undertaking which had old machinery (such as he enumerated in the present case) as being in a state of perfection. As to the reservoir, he would not regard this as a stable one by any means. The roof was not a permanently constructed one. The mains were exceedingly small in proportion to the requirements of the district; and this bore on the question of pressure. He admitted that it was not usual for water companies to have depreciation funds; but it was quite another thing when one came to assess the value of an undertaking. If the mains had not been depreciated, and their life was half gone, regard must be had to this fact, if one was asked to take over the undertaking as of first-class value. He found from experience that an all-round 1 per cent. was not excessive; and taking the total expenditure on the actual works at £25,000, this would amount to £250 a year. He could not believe the Company had an adequate supply of water at the present time; and the water was very hard. An undertaking of this description, paying maximum dividends, ought to be compensated on a 4 per cent. basis, which was 25 years' purchase, provided the concern was a good one. Here, however, the elements of uncertainty were so large that he found himself unable to assess the value of the undertaking at more than 20 years' purchase of the maximum dividends, which was £38,880. Then there were the debentures £4250, and £5797 in respect of over-spent capital—making a total of £48,927. The present inadequate supply had to be remedied; and this would put the Company to such an expenditure that the payment of back-dividends would be deferred indefinitely. Therefore he made no allowance for back-dividends. One element of insecurity was the chance of the rack-rent basis of charge being altered to the rateable basis. As to the over-spent capital, he had accepted the figures of the other side, but had taken off £1000, which he looked upon as excess expenditure on new offices.

Mr. *William Cash*, re-called, said the total consumption of water for the year ending June 26, 1909, as per the "Works Meter Register," was 118,081,000 gallons, or an average of 323,000 gallons a day; while the total for the year to June 25, 1910, was 133,404,000 gallons, and the daily average 365,000 gallons.

The UMPIRE: I have consulted the Arbitrators as to the proposed test; and it is suggested that, if there is any test at all, the truest and best test would be to pump No. 3 well to exhaustion, and not pump Nos. 1 and 2. This will involve some time and expense.

Mr. *Diggle* was then re-called, and cross-examined. He said he did not assume that the £1944 was amply secured, because of the condition of the undertaking. If the Company had gone on, the expenditure they would have had to face would have been such that they would not have had £1944 a year to divide. He would have advised the Company to lay on the Manton supply rather than take water from No. 3 well from the limestone. He based his calculations as to the need for new works on the assumption that the present works were capable of yielding only 300,000 gallons a day. If they would produce 365,000 gallons a day, another scheme would not be wanted. If the Company had the water they said they had, and it was of good quality, there was no risk whatever to the £1944.

Fourth Day.

Mr. *Diggle*, further cross-examined, said he believed it was a fact that the Company had voluntarily charged 20 per cent. less than their statutory charge, where owners agreed to pay the rates. In other cases they charged the maximum.

Mr. *Edward J. Silcock*, M.Inst.CE., said the records of the quantities of water pumped, so far as they had been supplied, did not show any satisfactory evidence that any increased quantity had been pumped since the alteration of the suction-pipe. He saw no reason to alter his opinion that, for the purposes of a dry year like 1908, the water required was not there. The water available for supply in a dry season had an all-important bearing on the maintainability of the revenue. Many of the mains were very small; and all those under 3 inches ought to be relaid at once. The figures of his valuation were the same as those of Mr. Diggle. In his opinion, there was no chance within any reasonable period of back-dividends being earned, if the undertaking was properly carried on and an adequate quantity of water supplied. Mr. Eaton and Mr. Terry in their valuations had put the same figure of percentage on the back-dividends, and taken the same rate of interest as they did for their number of years' purchase. But supposing any sum were allowed for back-dividends, this would be the wrong principle to adopt. It seemed to him that the back-dividends must be less secure than the maximum dividends, and therefore in capitalizing them, or discounting them, as in this case, one must take a higher rate of interest than one would when capitalizing the maximum dividends. If he had made any allowance, it would have been on the 6 per cent. table.

Cross-examined: Having regard to the elements of insecurity, he found, like Mr. Diggle, that the maintainable profit was £1347; but he calculated the 20 years' purchase on the maximum dividend of £1944. He considered justice must be done to the shareholders; and in his judgment it would be, on the basis of his valuation.

Fifth Day.

Mr. *George Rawson*, Engineer and Surveyor to the Council, and Chief Officer of the Fire Brigade, said he had formed the opinion, from practical observation and experience, that the mains of the Company were totally inadequate for the supply of the district generally. They were inadequate both for fire extinction and general supply.

Cross-examined: He could not say that the Council had ever, within his knowledge, officially complained to the Company about anything; but it was generally known in the town that there was an insufficient supply.

Mr. HONORATUS LLOYD: Do you mean to tell me that your Local Authority is such that it makes no complaint if it cannot get sufficient protection from fire?

Witness: I do not know of any official complaint being made.

Mr. *W. Brock Keen*, Chartered Accountant, said he had investigated the accounts of the Company in conjunction with Mr. Hawson; and they had agreed as to the tables that had been put in. Where the maximum dividend was being earned and paid, the capitalization should be so many years' purchase of this amount; and the maintainable profits would be only one factor in arriving at the valuation. There would, of course, be other factors to consider. As to the back-dividends, these were the least secure part of the value of the undertaking; and even if—which he entirely dissented from—the maximum dividends were to be capitalized on the 3 per cent. table, the back-dividends ought clearly not to be, because they were much more speculative. If the 3 per cent. table were altered in this case to 5 per cent., it would make a difference. But even if the back-dividends should by any chance be allowed, the period covered would unquestionably have to be very much extended beyond 1920. If in place of the practically 8½ years Mr. Cash adopted, they were to take 20 years (which would be a short enough time), and worked this out on the 5 per cent. table, the amount would come out at £4149, or taking 30 years at £3412—both these figures being dependent on the assumption that to begin with there was £1704 profit available up to June 30 next. If investing in a water company, supposing the works were in excellent condition and the supply ample, he would expect a 4 per cent. return on his money, or probably rather more. In the case of a willing seller, he thought a claim for cost of re-investment was absolutely inadmissible. Neither, to his mind, was there any reason for allowing the claim for debenture interest in lieu of six months' notice of repayment.

Mr. HONORATUS LLOYD (in cross-examination): Assuming it to be true that the Engineers' view is that for a period of about fourteen years there would be a deficiency for the maximum dividends, and that therefore they cannot be paid, you would still capitalize the full maximum dividend?

Witness: Yes; I should capitalize it in that case at a very much less number of years. But I have yet to learn that the Engineers have suggested that the profits will, in fact, be reduced in the way you assume. All I take it the Engineers have been endeavouring to arrive

at is what allowance should be made for elements of insecurity—a very different proposition from the one you are putting.

Mr. WEDDERBURN said this was his case; and he would now shortly state the views of the Council. The ideal award would be one which placed the shareholders in no worse and no better position than they were at the present time. Therefore they had to consider the nature of the investment which the shareholders in the Company possessed at this moment. Mr. Brock Keen had stated that in his view they had rather more than a 4 per cent. investment. The only evidence was that they were a Company who formerly were able to borrow at 4 per cent., but in 1908 had only been able to borrow at 4½ per cent. on their debentures. In 1908 they issued shares, and were able to raise money on them at 5 per cent. There was no doubt that the stocks of many excellent water companies had been bought to yield from £4 4s. to £4 13s. Under these circumstances, the Council might have said that the Company ought to be treated as a 5 per cent. concern; but they had said that it was a fair thing to take them at 4 per cent. If this were so, it followed that they started with 25 as the maximum number of years by which the amount of the maximum dividends would be multiplied, if there no elements of insecurity. If the Company received the £64,800 which they claimed under this head, they could invest in other water companies so as to receive over 4 per cent.; so that instead of £1944, they would get about £2600. Thus they would be giving the shareholders as a body a present of an additional income of £650. Such a thing was ludicrous. The suggestion of 33⅓ years was out of all reason. Taking 25 years, they would have to consider whether there were any elements of insecurity to reduce it. The Council contended that there were many such elements; and the first was the present position of the water supply. The Company came forward with none of the records which they ought to have kept. They were not able to state anything really definite about the quantity of water obtained from each well, which would be a valuable thing, over a prolonged period of changing seasons. They were not able to say what each engine had done. When in Parliament in 1909, the Company's statement was that they had for three years been short of water; and it was impossible to disregard this evidence. But on the first day of this arbitration, they were told a completely new story, and a very remarkable one—that in 1910 there had been certain changes made, which had entirely altered the whole condition of things, and that since then water, so to speak, had been pouring in. They knew from the evidence given in 1909 that in dry seasons there was a deficiency of water; and what evidence was there to show that exactly the same condition of things did not exist to-day? There was much to show that the Manton supply, which would, it was fully admitted, involve an additional expenditure, should be taken on at once. As to the mains, Mr. Diggle had summed up the matter when he said, "You cannot regard as a first-class undertaking one with mains which are to the extent of 76 per cent. 2-inch and 3-inch mains." There should also be a depreciation fund; and an extra allowance for repairs was necessary. The last point was that of a water tower. These five elements of insecurity were placed at a figure of £1412; and if this was sound, of course, the back-dividends were done away with, and the £1944 maximum dividend was also touched. There were also other elements of insecurity which could not be appraised in money; but they might say, as Mr. Silcock did, that they would take off a year's purchase for them. First, there was the chance of the reservoir again collapsing, as it did once before. Then came the hardness of the water; the fact that two of the wells were non-statutory; and, lastly, there was the serious risk of a reduction of rack-rent to rateable value. For all the considerations he had enumerated, they knocked five years off the maximum of 25 years' purchase. If the tribunal found that the Council had invaded the £1944 to the extent of £597, five years could not be thought an unreasonable number to knock off the number of years by which the £1944 was to be multiplied—with no back-dividends, because these also, if he was correct, had gone. As to over-spent capital, he would add nothing to what his witnesses had said. The remaining matter was the £1296 for re-investment, &c. This seemed to be largely, if not entirely, a question of law. In the case of a compulsory sale, 10 per cent., or some other amount, would be allowed to cover cost of re-investment and all sorts of other things; but here there was a section expressly stating that the Company were to be regarded as vendors by agreement. Therefore it was a surprise to him to find the point raised.

Mr. HONORATUS LLOYD, in reply, remarked that he could not understand the principle on which the Engineers on the other side had adopted their valuation. He thought it was now universally accepted that what one had to purchase was the maintainable profit, subject to the limit which could be divided among the shareholders. The Company had shown that on revenue account they had a balance of profit available of £3147, allowing for repairs at an average figure over six years. Mr. Diggle wanted an additional £136 for repairs, as well as £250 for depreciation—though he said fairly enough that he did not know of a single company that had ever provided any such fund, or, in other words, that whatever sum was necessary was spent upon repairs from year to year as and when required. After all the evidence that had been given, he would again maintain that there was an ample supply of water—that the Company were mistaken in 1909, and that the explanation they had now given of the matter was a perfectly honest one. Even if it should unfortunately be held that the Company were short of water, Mr. Diggle's estimate of the cost of utilizing the Manton water was a monstrous one. Then, again, Mr. Diggle said: "I want larger mains; and I want a higher water-tower, in order that, not only with the present but the future development, you shall give better pressure." There was, however, no obligation to provide a tower at all; and as for the mains, though these could doubtless be improved in some instances, whatever was done would not affect the payment of the maximum dividend. As to the insecurity elements on which it was said to be impossible to place a money figure, but for which a year's purchase was proposed to be deducted, it was true that there was once a crack in the reservoir; but this had been put right, and no trouble had since arisen. Then the risk of abandoning the present supply of water on account of its hardness was really too ludicrous; while as to the non-statutory character of wells Nos. 2 and 3, this was the merest technicality.

The award has not yet been announced.

SALFORD WATER SUPPLY.

Alleged Defective Meter Registration—Checking Waste.

The alleged faulty registering of a meter has led to the Salford Corporation making a claim for £1500 from the Water Committee of the Manchester Corporation; and negotiations are proceeding with a view to an amicable settlement of the matter. The meter in question is situate at the boundary of the borough, and is one of several in use for registering the quantity of water Manchester supplies to Salford. It is alleged that the meter, which was put down in 1906, has on a number of occasions been found to be inaccurate, and registering in favour of Manchester. After having expert advice, the Water Committee of the Salford Corporation put in a claim for £1500 as overcharges—the amount being based upon the time the meter has been in use. The officials in the Manchester Water Department assert that they are in possession of facts and figures which enable them to fix fairly accurately the amount Salford has been overcharged through the faulty registering of the meter. There is a wide difference between the two sets of figures; but it is hoped that at a conference between the two Committees a settlement will be reached.

Some time ago, the Salford Water Committee called in Mr. Diggle to advise them as to the consumption of water in the borough; there being a conviction that something ought to be done to check the undoubted waste that was going on. A Sub-Committee has had the matter in hand, and, as the result of Mr. Diggle's recommendations, a number of economies have been effected where it was found that water was being wasted. At last Friday's meeting of the Committee, it was stated that the reforms already carried out had resulted in a saving of about £200 to the department during the last quarter.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The proceedings in the Kirkcaldy gas arbitration have advanced so far this week that the Company have closed their case, and the case for the Corporation has been opened. The Accountant for the Corporation (Mr. R. Cockburn Millar) was in the witness-box the whole of to-day, and is still under cross-examination. Mr. Millar was some years ago called in to advise as to the finances of the Gas Company. His evidence to-day was given altogether independently of that report—this course being followed by agreement of the parties. The Company's engineering and other evidence is to be taken in London; and before rising to-day, the Oversman impressed upon the parties the desirability of their being able to sit day by day till the evidence is finished and Counsel heard. It is interesting to observe how one case differs from another. After the Corporation began to prepare for this arbitration, they discovered the restricting agreement of 1845. It is being used with all possible pressure by the Corporation; and on the side of the Company, it is being treated with almost contempt—the attitude being that there was no agreement to begin with, and that, if there were, it was never acted upon by either of the parties. I presume the Arbiters will have little difficulty in arriving at a valuation, upon the lines on which other undertakings have been valued, and that the only real difficulty they will encounter will be as to the existence of this agreement, and as to its effect, whether it existed or not, upon the minds of those who formed the Company on the one hand and of the community on the other, in the matter of affecting profits.

It was reported to the Glasgow Town Council on Thursday that, at a meeting of the Gas Committee on the 11th inst., the Town Clerk submitted a copy of the Busby and District Gas Order, 1911, and reported that objections to it required to be lodged on or before the 14th inst. It was pointed out that, under clause 5 (limits of supply) of the Order, the Busby Gas Company proposed to include certain territory adjacent to the estate of Netherton, in the parish of Mearns, which territory, though not included within the limits of supply in the Glasgow Gas Act of 1910, they had agreed should form part of the Corporation's area of supply. The Committee, it was stated, having heard the Engineer, were of opinion that it was desirable that the Corporation should be free, should the necessity arise, to extend their gas-mains along the Clarkston Road, in the parish of Mearns, and form a junction with their main in Kilmarnock Road which supplies the estate of Netherton, which was last year included within the statutory area of supply of the Corporation. It was also pointed out that clause 13 (power to maintain mains in the parish of Cathcart) was not in accordance with the agreement entered into with the promoters in 1908, under which the Corporation purchased the portion of the Busby Company's gas undertaking in the parishes of Cathcart and Eastwood; and that clause 10 (power to purchase additional lands by agreement) and clause 14 (power to supply gas-fittings) were objectionable in this respect, that they conflicted with the Corporation's rights as gas undertakers in the parishes of Cathcart and Eastwood. The Committee instructed the Town Clerk to report to the Parliamentary Bills Committee that in the interests of the Gas Department of the Corporation, objections to the Order should be lodged with the Board of Trade in regard to the clauses mentioned. The Parliamentary Bills Committee, meeting on the same day, agreed to lodge objections.

A special meeting of the Falkirk Town Council was held on Thursday evening, to consider what was, in effect, a charge against Bailie H. Russell, a former Convener of the Gas Committee, of having improperly used gas. In Falkirk, gas for lighting is charged for at the rate of 2s. 9d. per 1000 cubic feet, and for power purposes at 2s. 4d. There is no special charge for gas for heating. When an account for £1 6s. 2d. was presented to Bailie Russell he disputed the amount. The Convener and the Gas Manager thereupon visited his works; and there they discovered that six connections had been made with a power meter which were not for power purposes—one being for a blowpipe, and some for flat-flame burners. The Gas Committee, by a majority, recommended that, as in their view the connections were infringements of the Gas Acts, a modified penalty of £1 be imposed on Bailie Russell, and that it

be remitted to the Burgh Chamberlain and the Gas Manager to furnish Mr. Russell with an account for the gas used for lighting purposes which had already been charged for at the power rate. This recommendation was moved in the Council. Treasurer Wallace moved, as he had done in Committee, that, while recognizing that a technical offence had been committed, they were satisfied that in making the connections Bailie Russell was acting in the belief that he was not causing the Town Council to suffer any loss, and that no penalty be imposed. He said they had heard the explanation of Bailie Russell, which was to the effect that formerly he had an allowance of 10s. per annum from the Town Council in respect of two heating-stoves which he had off his lighting meter; and that, while putting in the six connections, he was satisfied that the Town Council were getting compensation, in respect that these two stoves were still on the lighting meter. Bailie Russell, in explanation, admitted that he made alterations at his works in July which were unauthorized; but he contended that all the possible gain he could have had was 2s. 6d. a year, and as he paid £100 a year for gas, he did not think that anyone would believe that, for the sum of 2s. 6d., he would put himself into a fraudulent and dishonest position. The reason that this had been brought up was simply that he had disagreed with the Gas Manager as to his method of conducting the business. The recommendation of the Committee to impose a penalty of £1 was agreed to by a large majority. Bailie Russell has intimated, through the local Press, that, acting on the advice of his agents, he has challenged the Town Council's resolution as incompetent and beyond their powers, and has called upon the Council to follow it up with legal proceedings, which he will defend.

The Grangemouth Town Council on Monday had a tussle over the subject of public lighting. The question was introduced by Bailie White, the Convener of the Lighting Committee, who moved that the words "so that the gas used in the lamps can be charged for on the average shown by these meters," contained in a resolution adopted on May 17, 1909, with reference to the placing of meters upon public lamps, be rescinded and deleted. He contended that the account for gas had been arranged purposely to trick the Town Council, and to get from them more than the Gas Department were entitled to. According to contract, the charge should have been at the rate of 2s. 8½d. per 1000 cubic feet; but instead of this, they had been charged 3s. 4d. This, with extra hours charged, made up a sum of £52, which the gas undertaking, in his opinion, were not entitled to. The account for gas for the public lamps amounted to £505; and they were being asked to pay at the same rate as the man who burned 3s. 4d. worth. In 1906-7, when they took over the gas-works, the account for street lighting was £288; and in 1910 it was £505. He believed the Lighting Committee were quite justified in asking the Town Council to reconsider their terms for street lighting. There were in 1906-7, 228 lamps; in 1910, they numbered 279. So that the increase in number was about one-fifth; whereas the charge was almost double. The motion, it was agreed, would not affect the estimates for this year. Bailie Main, the Convener of the Gas Committee, moved the previous question. It was a well-known fact, he said, that the public lamps, consumed more than 3 cubic feet per hour, and this was the reason why the meters were put on. If it were the rate that objection was taken to, they were going the wrong way about the business. Let them appoint a Committee to consider whether a reduction could be made to all consumers. The previous question was carried by six votes to three. Bailie White resigned the convenership of the Lighting Committee. They had, he said, given the Council sufficient information to call for an inquiry; but apparently the Town Council were a dead wall against inquiry. It was moved that a Committee be appointed to investigate an alleged breach of contract between the Gas Department and the Town Council, whereby the Council were charged 3s. 4d. per 1000 cubic feet, instead of 2s. 8½d. as contracted for, and to report, with recommendations. Bailie White seconded, and said that if the motion were adopted he should be quite willing to remain on the Lighting Committee, and to give every facility for inquiry. The motion was adopted; the Committee appointed being the whole Council.

CURRENT SALES OF GAS PRODUCTS.

[For Table of "Tar Products Prices," see p. 254.]

LIVERPOOL, *Jan.* 21.

Sulphate of Ammonia.

During the past week, the demand has slackened off to a certain extent, and consequently the tone of the market has become somewhat quieter. There has, however, been no weakening of values, and in a few instances a still further advance of 1s. 3d. per ton has been scored. There have been rather more requirements for home consumption, but these are as yet insufficient to make any appreciable effect on prices. The closing quotations are £13 5s. to £13 6s. 3d. per ton f.o.b. Hull, £13 6s. 3d. to £13 7s. 6d. per ton f.o.b. Liverpool, and £13 8s. 9d. to £13 10s. per ton f.o.b. Leith, for prompt delivery. In the forward position, business has been done for January-March shipment at prompt values, but no further transactions have transpired beyond that period. Makers maintain their strong opinions, and are holding out for £13 10s. per ton f.o.b. Leith for equal monthly quantities up to June, and for £13 per ton for July-December delivery.

Nitrate of Soda.

The position of this article continues without any alteration; the spot market remaining quiet but steady at 9s. 6d. and 9s. 9d. per cwt. for ordinary and refined qualities respectively.

LONDON, *Jan.* 23.

Tar Products.

The markets have been firm during the past week. Pitch has been exceedingly firm, and there are very few makers who are willing to sell at much below 39s. to 40s. per ton, although there are, of course, second-hand parcels offering at something under this. There is a fair demand from the Continent, though at present buyers are rather diffident about paying the prices asked. In South Wales, there is a fair demand; and it is believed that there is a large quantity to be bought in this quarter. Creosote is steady, but with very little inquiry; and prices in most cases are purely nominal. Benzol is very firm indeed for delivery over the first three months of this year; but buyers will not pay the spot prices for delivery all over the year. Fifty-ninety per cent. benzol is also firm, though there is not so much demand as for 90 per cent. Toluol remains unchanged, and there is some inquiry for it; but at present consumers will not pay the prices asked by makers. Solvent naphtha is quiet; but the majority of manufacturers appear to be fairly comfortable, and under no necessity to sell. Heavy naphtha is quiet, and there is not very much business doing. Carbolic acid is steady; but business is difficult to negotiate, though occasionally high prices are reported to have been paid. Crystals are very dull, and makers are finding considerable difficulty in placing their stocks. Cresylic acid is very firm, and the demand from the Continent continues. Creosote salts are steady, owing principally to the home demand. Refined naphthalene is quiet, and with unchanged values. Tar is still being eagerly competed for in all quarters.

The average values during the week were: Tar, 18s. 9d. to 22s. 9d., *ex* works. Pitch, London, 38s. to 38s. 6d.; east coast, 38s. to 38s. 6d.; west coast, Manchester, 37s. to 37s. 6d., Liverpool, 38s. to 38s. 6d., Clyde, 38s. to 39s. Benzol, 90 per cent., casks included, London and North, 9d. to 9¼d.; 50-90 per cent., casks included, London and North, 8¼d. to 9d. Toluol, casks included, London, 9¾d.; North, 9½d. Crude naphtha, in bulk, London, 3¾d. to 4¼d.; North, 3d. to 3¼d.; solvent naphtha, casks included, London, 11¼d. to 1s.; North, 10½d. to 11d.; heavy naphtha, casks included, London, 11⅜d. to 1s.; North, 10⅜d. to 11d. Creosote, in bulk, London, 2¼d. to 2⅜d.; North, 1⅝d. to 2d. Heavy oils, in bulk, 2⅜d. to 2¾d. Carbolic acid, 60 per cent., casks included, east coast, 1s. 0¼d. to 1s. 1d.; west coast, 1s. to 1s. 0¼d. Naphthalene, £4 10s. to £8 10s.; salts, 40s. to 45s., bags included. Anthracene, "A" quality, 1½d. to 1¾d. per unit, packages included and delivered.

Sulphate of Ammonia.

This article has been steady throughout the past week. The principal Gas Companies to-day are quoting £12 17s. 6d. for 25 per cent., and report that they have very little to sell for near delivery. There are some sellers of second-hand parcels of Beckton at £12 15s. to £12 16s. 3d; but there is very little even of this. Outside London, makes rule about £12 15s. In Hull, £13 6s. 3d. has been paid for ordinary makes, and for the best makes £13 7s. 6d.; and in Liverpool £13 7s. 6d. is also reported. In Leith, £13 8s. 9d. has been refused, and £13 10s. is now asked, and there is not now much to sell even at this; while in Middlesbrough the price rules about £13 6s. 3d. to £13 7s. 6d.

COAL TRADE REPORTS.

Northern Coal Trade.

There has been more activity in the coal trade; but, with an adequate supply, the prices have shown a slight ease. In the steam coal trade, the prices of best Northumbrians range from 9s. 10d. to 10s. 3d. per ton f.o.b., second-class steams from 8s. 6d. to 8s. 9d., and steam smalls from 4s. 9d. to 6s. 3d. The production at the collieries is full, and it is well taken up generally. In the gas coal trade, the demand is still very heavy; but the supply is ample, and the long contracts are being well met. Durham gas coals vary from 8s. 9d. to 9s. 6d. per ton f.o.b., according to quality; and for "Wear" specials, up to 10s. 9d. is now quoted. There has been a settlement of the contracts for the Copenhagen Gas-Works supply; and it is believed the price is a little above 10s. per ton f.o.b. for "specials." The Riga supply is also being tendered for. In coke, the market is steady. Gas coke is firm, with prices varying from 14s. to 15s. per ton f.o.b.

Scotch Coal Trade.

The market is very quiet. Ell for shipment is in poor demand. Splint is still moving freely. Steam coal for home consumption is in steady demand. All classes of washed stuffs and dross are in good request. The prices now quoted are: Ell, 9s. 6d. to 10s. 3d. per ton f.o.b. Glasgow; splint, 10s. 3d. to 10s. 6d.; and steam, 9s. 6d. to 9s. 9d. The shipments for the week amounted to 236,595 tons, an increase of 87,147 tons upon the previous week, but a decrease of 27,311 tons upon the corresponding week of last year. For the year to date, the total shipments have been 442,093 tons, an increase upon the corresponding period of 25,344 tons.

The employees of the Reading Gas Company held their eighth annual dinner last Wednesday evening, under the presidency of Mr. D. H. Helps, the Engineer and Manager. The toast of "The Chairman and Directors of the Reading Gas Company" was proposed by Mr. H. Baker, the Assistant-Engineer, who asked Mr. Helps to convey to the Directors, at their next meeting, the thanks of all present. The toast having been very heartily honoured, Mr. Helps said it gave him very great pleasure to thank the employees, on behalf of the Directors, for the way in which they had received it. He could assure them that the Directors took a very kindly interest in all who were in their service, and that this interest took a practical form. The Directors had three duties to discharge—to the consumers, to the shareholders in the Company, and to the employees; and in each case they had done their duty thoroughly. He added that their esteemed Chairman (Mr. J. Okey Taylor, J.P.), the "father of the Company," was always pleased to hear of these annual gatherings. Mr. C. H. Eves proposed the health of the Chairman of the evening, coupling with the toast the name of Mrs. Helps. The Chairman acknowledged the toast, and afterwards made a presentation, on behalf of the members of the Cricket Club, to Mr. G. Curtis, who is leaving the Company's service in order to take up a position as inspector to the Exeter Gas Company. Mr. Curtis acknowledged the presentation, consisting of a handsome oak writing-desk and cabinet.

Church Lighting by Incandescent Gas.

St. John's Parish Church, Cardiff, has lately been equipped with incandescent gas-lights, which have taken the place of the flat-flame burners hitherto used. The change has naturally given the greatest satisfaction—a feeling which is voiced by the "Western Mail" in the following words: "There is no doubt that the lofty roof and the whole of the church benefit from the new arrangement; and St. John's is well worth a visit, if only to notice this great improvement. But what will appeal to the ordinary man is the interesting fact that, with more than double the quantity of light, the new inverted burners consume quite two-thirds less quantity of gas compared with the old, ineffective, wasteful, flat-flame burners. Indeed, the illuminating power has been increased by four-and-a-half times at this decreased cost. Altogether there are 86 inverted incandescent burners, compared with 127 flat-flame burners under the old arrangement. The pulpit light is controlled by an automatic switch, which the preacher touches on entering and leaving the pulpit. The effect is striking, and forms another testimony to the thorough methods of the Cardiff Gas Company, who have been responsible for the effective improvement." Three-light brackets have been fixed up on each pillar of the nave; and each of the side pillars has a two-light bracket. Each bracket is so arranged that all but a single light in every case can be switched off. Even when this is done, however, it is pointed out that the reduced power is fully equal to the discarded arrangement when every burner was in use.

Water Gas Litigation at Lyons.—For about three years, the question of the supply of water gas mixed with coal gas has been receiving considerable attention in Lyons, in consequence of a manufacturer in the City—M. Fahy—instituting proceedings against the Gas Company to stop the distribution of the mixture, as being detrimental to the public health. The subject was investigated by three experts, representing the Company, the Municipality, and M. Fahy respectively; and two were against the use of water gas. The matter was the subject of a long report recently presented to the Municipality by the Mayor (M. Herriot), who asked for authority to join M. Fahy as co-plaintiff in his action; and it was granted. The Company take their stand on the article of their concession which gives them the right to mix coal gas with that produced from any other substance, provided that the mixture is not more dangerous to the public than coal gas alone.

Improved Gas Lighting in High Street, Lewisham.—The Works Committee of the Lewisham Borough Council have received further applications from the South Metropolitan Gas Company and the South Metropolitan Electric Light and Power Company, Limited, for permission to erect lamps on the public footway. The Gas Company's application was in respect of the front of shops in a portion of High Street, Lewisham, and in Lewis Grove. The Electric Light Company also applied in respect of a portion of High Street. The Borough Surveyor informed the Committee that there is a culvert under the footway in front of certain houses in High Street, and therefore that it is not desirable that lamps should be erected there. He further stated that the pavement in Lewis Grove was altogether too narrow for the proposed lighting. The application of the Gas Company is to be granted, subject to the usual protective conditions, in respect of High Street.

Reductions in the Price of Gas.

We learn from the Secretary of the Australian Gaslight Company (Mr. R. J. Lukey) that the Directors have, as from the 1st inst., reduced the price of gas supplied by meter 3d. per 1000 cubic feet, and the charge for public lighting 5s. per lamp per annum. The ordinary price of gas is now 3s. 9d. per 1000 cubic feet, and the charge for the public lighting £3 15s. per lamp per annum for 300 nights in the year. The Directors of the North Shore (Sydney) Gas Company have reduced the price of gas to private consumers by 3d. per 1000 cubic feet, making the figure 3s. 9d., as from the 1st inst. They have also made an equivalent reduction in the price paid by consumers through prepayment meters, to take effect as soon after the New Year as the necessary alterations could be made in the meters. They have likewise reduced the charge for public lighting by 5s. per lamp per annum. At a recent meeting of the Directors of the Manly (N.S.W.) Gas Company, Limited, it was decided to reduce the price of gas supplied by meter from 4s. 9d. to 4s. 2d. per 1000 cubic feet—the reduction to take effect from the 1st inst. The Lewes Gas Company have reduced the price of gas from 3s. 8d. to 3s. 6d. per 1000 cubic feet. As from the 1st of April, the price of gas for lighting, heating, and cooking in Sunderland will be reduced by 2d.; making the gross price 1s. 10d. per 1000 cubic feet. This is subject to discounts ranging from 1d. to 6d. if paid within one month of the expiration of the quarter. The net price will now range from 1s. 9d. to 1s. 4d. The Directors of the Southampton Gas Company announce that from the 1st prox. the quantity of gas supplied for a penny by prepayment meters in the added areas of Freemantle, Shirley, Portswood, and Bitterne Park will be increased from 20 to 23 cubic feet.

Water Supply Troubles in Pembrokeshire.—The Fishguard Urban District Council, the Llanwrda Parish Council, and property owners in both administrative areas, have petitioned the Board of Trade objecting in strong terms to the powers sought by the North Pembrokeshire Water and Gas Company under the Provisional Order for which they are applying. The Company have been called upon to pipe their source of supply from the springs to the reservoir, under penalty of the attention of the Local Government Board being drawn to the danger of pollution which exists at the gathering-grounds. The Haverfordwest Rural District Council have notified the Company that unless steps are taken to ensure the purity of the water supply they will prohibit its use in Goodwick.

St. Pancras Electric Lighting Criticized.—On the ground that one of the local newspapers criticized "beyond the grounds of fair comment" the municipal electricity undertaking, the Electric Light Committee of the St. Pancras Borough Council recommended the discontinuance of an advertisement now running in the paper at a charge of £20 a year. When the matter came before the Council last Wednesday, a long discussion ensued on a proposal to delete the recommendation. Some of the members characterized the criticism as beneath contempt; while others thought it was justified, and suggested that the best way to meet it was to improve the lighting. Eventually the recommendation was referred back to the Committee for further consideration.

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 215.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
1,551,863	Stk.	Oct '4	5	Alliance & Dublin Ord. .	81–84	+1	5 13 1
374,000	Stk.	Jan. 13	4	Do. 4 p.c. Deb.	91–95*	..	4 3 4
200,000	5	Oct. 28	7	Bombay, Ltd.. . . .	6½–7	..	5 0 0
40,000	5	,,	7	Do. New, £4 paid .	5–5½	..	5 1 10
50,000	10	Aug. 31	15	Bourne- } 10 p.c. . .	28½–29½	..	5 1 8
311,810	10	,,	7	mouth Gas } B 7 p.c. .	16½–16¾	..	4 3 7
75,000	10	,,	6	and Water } Pref. 6 p.c.	14¾–15¼	..	3 18 8
380,000	Stk.	Aug. 12	12½	Brentford Consolidated	254–257	..	4 17 3
330,000	,,	,,	9½	Do. New . . .	156–159	..	4 15 6
50,000	,,	,,	5	Do. 5 p.c. Pref. .	120–122	..	4 2 0
206,250	,,	Dec. 15	4	Do. 4 p.c. Deb. .	98 100	..	4 0 0
220,000	Stk.	Aug. 31	11	Brighton & Hove Orig.	218–221	..	4 19 7
246,320	,,	,,	8	Do. A Ord. Stk. .	158–161	..	4 19 5
460,000	20	Sept. 29	10⅝	British	44–45	..	4 14 5
109,000	Stk.	Aug. 11	6	Bromley, A 5 p.c. . .	119–121	..	4 19 2
165,700	,,	,,	4½	Do. B 3½ p.c. . .	89 91	..	4 15 11
82,278	,,	,,	5⅜	Do. C 5 p.c. . .	109–111	..	4 19 1
5 ,000	,,	Dec. 30	3½	Do. 3½ p.c. Deb. .	83–85	..	4 2 4
250,000	Stk.	,,	4	Buenos Ayres 4 p.c. Deb.	95–97	..	4 2 6
100,000	10	—	—	Cape Town & Dis., Ltd.	3–4	..	—
100,000	10	—	—	Do. 4½ p.c. Pref. .	5–6	..	—
50,000	50	Nov. 2	6	Do. 6 p.c. 1st Mort.	—	..	—
100,000	Stk.	Dec. 30	4½	Do. 4½ p.c. Deb. Stk.	88–90	..	5 0 0
157,150	Stk.	Aug. 12	5	Chester 5 p.c. Ord. . .	109½–111½	..	4 9 8
1,513,280	Stk.	,,	5⅛	Commercial 4 p.c. Stk. .	110–113	..	4 12 0
560,000	,,	,,	5	Do. 3½ p.c. do. .	104–107	..	4 13 6
475,000	,,	Dec. 15	3	Do. 3 p.c. Deb. Stk.	77–79	..	3 15 11
800 000	Stk.	,,	4	Continental Union, Ltd.	48–51	..	4 7 11
200,000	,,	,,	7	Do. 7 p.c. Pref.	131–136	..	5 2 11
491,270	Stk.	—	5½	Derby Con. Stk. . . .	122–124	..	4 8 9
155,000	,,	—	4	Do. Deb. Stk. . . .	104–105	..	3 16 2
140,995	,,	Oct. 14	5	East Hull 5 p.c. Ord. .	103–105	..	4 11 3
486,090	10	July 14	12	European, Ltd. . . .	24–24¾	..	4 18 0
354,060	10	,,	12	Do. £7 10s. paid.	18¾–18¾	+¼	4 16 0
16,179,445	Stk.	Aug. 12	4⅝	Gas } 4 p.c. Ord. . .	106½–107½	+⅛	4 6 9
2,600,000	,,	,,	3⅛	light } 3½ p.c. max. .	86–88	..	3 19 7
4,062,235	,,	,,	4	and } 4 p.c. Con. Pref.	103–105	..	3 10 2
4,531,705	,,	Dec. 15	3	Coke } 3 p.c. Con. Deb.	78–80	..	3 15 0
258,740	Stk.	Sept. 15	5	Hastings & St. L. 3½ p.c.	93–55	..	5 5 3
82,500	,,	,,	6⅛	Do. do. 5 p.c.	114–116	..	5 12 1
70,000	10	Oct. 14	11	Hongkong & China, Ltd.	17–17½	..	6 5 8
131,000	Stk.	Sept. 15	5⅛	Ilford A and C . . .	146–149	..	4 19 0
65,780	,,	,,	5⅛	Do. B	115–117	..	5 0 5
65,500	,,	Dec. 30	4	Do. 4 p.c. Deb. . . .	95–98	..	4 1 8
4,940,000	Stk.	Nov. 11	9	Imperial Continental .	185–187	..	4 16 3
1,235,000	Stk.	Aug. 12	3⅛	Do. 3½ p.c. Deb. Red.	14–96	..	3 12 11
200,242	Stk.	Aug. 31	6	Lea Bridge Ord. 5 p.c. .	121–123	..	4 17 7
561,000	Stk.	,,	10	Liverpool United A. .	220–222	..	4 10 1
718,100	,,	,,	7	Do. B . .	164–165	..	4 4 10
306,083	,,	Dec. 30	4	Do. Deb. Stk.	102–104	..	3 16 11
75,000	5	Dec. 15	6	Malta & Mediterranean.	4⅜–4¾	..	6 3 1
560,000	100	Oct. 1	5	Met. of } 5 p.c. Deb.	100–102	..	4 18 0
250,000	100	,,	4½	Melbourne } 4½ p.c. Deb.	100–102	..	4 8 3
541,920	20	Nov. 11	3⅜	Monte Video, Ltd. . .	12¼–12⅝	..	5 9 10
1,775,892	Stk.	July 28	4⅜	Newc'tle & G'tesh'd Con.	101¼–102½	–½	4 5 4
529,435	Stk.	Dec. 30	3⅜	Do. 3½ p.c. Deb.	89–90	..	3 17 9
55,940	10	Aug. 31	7	North Middlesex 7 p.c.	138–143	..	4 16 7
300,000	Stk.	Nov. 30	8	Oriental, Ltd. . . .	137–139	..	5 14 1
60,000	5	Sept. 15	8	Ottoman, Ltd. . . .	6¼–7⅛	..	5 18 6
31,800	53	Aug. 31	13	Portsea Island A. . .	133–135	..	5 1 8
60,000	50	,,	13	Do. B. . .	126–128	..	5 1 7
100,000	50	,,	12	Do. C. . .	119–121	..	4 19 2
114,800	50	,,	10	Do. D and E.	103–105	..	4 15 3
398,490	5	Oct. 28	7	Primitiva Ord. . . .	7⅜–7⅝	+⅛	4 11 10
796,980	5	Dec. 30	5	Do. 5 p.c. Pref. .	5¼–5½	..	4 10 11
488,900	100	Dec. 1	4	Do. 4 p.c. Deb. .	95–97	..	4 2 6
312,650	Stk.	Dec. 30	4	River Plate 4 p.c. Deb. .	95–97	..	4 2 6
250,000	10	Sept. 29	9	San Paulo, Ltd. . . .	15⅜–15⅝	..	5 14 3
115,000	10	,,	6	Do. 6 p.c. Pref. .	11⅜–12	..	5 0 0
125,000	50	Jan. 3	5	Do. 5 p.c. Deb. .	50–51	..	4 18 0
135,000	Stk.	Aug. 31	10	Sheffield A	229–231	..	4 6 7
209,984	,,	,,	10	Do. B	229–231	..	4 6 7
523,500	,,	,,	10	Do. C	229–231	..	4 6 7
70,000	10	Oct. 14	6	South African	10¾–11	–¼	5 9 1
6,429,895	Stk.	Aug. 12	5/9/4	South Met., 4 p.c. Ord.	121–123	..	4 8 10
1,895,445	,,	Jan. 13	3	Do. 3 p.c. Deb.	78½–80½*	..	3 14 6
209,822	Stk.	Aug. 31	8	South Shields Con. Stk.	155–157	..	5 1 1
605,000	Stk.	Aug. 12	5⅜	S'th Suburb'n Ord. 5 p.c.	122–122	..	4 12 9
60,000	,,	,,	5	Do. 5 p.c. Pref. .	123–122	..	4 2 0
117,058	,,	Jan. 13	5	Do. 5 p.c. Deb. Stk.	120–121*	..	4 2 0
502,310	Stk.	Nov. 11	5	Southampton Ord. . .	110–111	..	4 9 3
120,000	Stk.	Aug. 12	7	Tottenham } A 5 p.c. .	141–143	..	4 17 11
483,940	,,	,,	5⅛	and } B 3½ p.c. .	113–115	..	4 15 8
149,470	,,	Dec. 15	4	Edmonton } 4 p.c. Deb.	95–97	..	4 2 6
182,380	10	Dec. 30	8	Tuscan, Ltd.	9–9⅜	..	8 8 6
149,900	10	Jan. 3	5	Do. 5 p.c. Deb. Red.	97–99	..	5 1 0
236,476	Stk.	Aug. 31	5	Tynemouth, 5 p.c. max.	114–115	..	4 6 11
255,636	Stk.	Aug. 31	6⅜	Wands- } B 3½ p.c. . .	142–144	..	4 13 7
85,765	,,	Dec. 30	3	worth } 3p.c. Deb. Stk.	73–75	..	4 0 0

Prices marked * are "Ex. div."

Whooping-Cough Relieved by Gas-Works Fumes.

"Engage a house close to some gas-works, and take frequent motor-car rides. These are the latest hints for child and adult patients suffering from whooping-cough." An experienced doctor lately gave this advice to the "Daily Mirror," in connection with the large number of cases of whooping-cough in London just now. He said: "Judging from individual cases of this affection which have come under my notice, it is undoubtedly beneficial for patients to live in close proximity to gas-works. It is not the smell of the gas which has a bracing and salutary effect, but the vapours which are given off by the materials used for purifying the gas. Oxide of iron, lime, and other chemicals, are used for this purpose, and ammonia and sulphuretted hydrogen fumes are generated. Coal-tar vapours are also present at gas-works. Although whooping-cough is a form of nervous disease, it is caused originally by germs; and these vapours possess properties which are especially deadly to the life of these organisms. The fact remains, however, that whooping-cough patients invariably pick-up rapidly when removed to a house adjoining gas-works."

Sales of Stocks and Shares.

At the Mart, Tokenhouse Yard, E.C., last Tuesday, Messrs. A. & W. Richards resumed their sales of gas and water companies' stocks and shares; all the lots being offered under instructions from executors. The first consisted of £10 fully-paid original shares in the South-West Suburban Water Company, ranking for a maximum dividend of 10 per cent., but carrying 6¼ per cent.; and they fetched from £16 10s. to £16 15s. each. Some £10 ordinary shares and second 4 per cent. preference stock of the Lowestoft Water and Gas Company were next submitted. The shares ranked for a maximum dividend of 7 per cent., but carried 5¼ per cent.; and they were sold for £10 15s. apiece. The preference stock sold at £92 to £93 per £100. A parcel of £10 fully-paid additional or new ordinary 7 per cent. shares (present dividend 4½ per cent.) in the Southend Water Company realized £10 7s. 6d. per share; and some new ordinary 5 per cent. shares of the same nominal value, the present dividend on which is 4½ per cent., were sold at par. Some new ordinary 7 per cent. stock of the Great Yarmouth Water Company, carrying 4 per cent. dividend, fetched £93 to £94 10s. per £100. The last lots submitted were some £10 fully-paid 8 per cent. "B" shares in the Tendring Hundred Water Company, carrying 4½ per cent.; and they fetched £11 5s. and £11 7s. 6d. each.

Death from Suction-Gas Poisoning.—A verdict of "Accidental death" was returned by a Coroner's Jury who inquired into the circumstances under which John Ganley, of Openshaw, died at a Clayton factory. It appears that deceased was instructed to clean out a portion of a suction plant from which it was thought all the gas had been expelled; but some must have remained in the neighbourhood of the plant, as he was subsequently found "gassed."

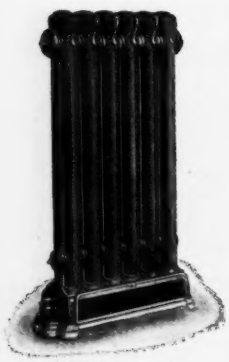
New Water Supply for Newbiggin-by-Sea.

A new water supply for the urban district of Newbiggin was inaugurated last Wednesday; the ceremony of turning on the water being performed by Mrs. Ralph Rutherford (the wife of the Chairman of the Council), who was presented with a silver key by Mr. Sinclair, on behalf of the Contractors (Messrs. Blair, of Glasgow). Mr. W. A. Cuttriss was Engineer to the scheme, which has cost approximately £6300. In the course of a short account of the undertaking, Mr. Rutherford said an agreement was entered into between the Council and the Tynemouth Corporation on April 17, 1907, to supply the Newbiggin district with water at 4d. per 1000 gallons. At that time, there was no possible alternative to the Council taking the Tynemouth water. The original scheme was to bring the water-main from Pigdon, through Morpeth, Pegswood, and Ashington, to Newbiggin; but it had to be abandoned on account of the cost. Subsequently, another scheme was approved, to take the Tynemouth water from Ewart Hill and carry it along the highway through Bedlington, Choppington, over the Stakeford Bridge, through North Seaton, and on to Newbiggin—a distance of nearly 8 miles. Powers to borrow £6800 to carry out the work were sanctioned by the Local Government Board; and out of 21 tenders the contract was awarded to Messrs. Blair. The work was commenced on June 10 last, and had been expeditiously carried out under the supervision of Mr. Cuttriss. Temporary stand-pipes would be erected until the branch mains were completed. The mains had been designed to give a supply of 316,000 gallons per day; and there was a pressure of 200 lbs. per square inch. He was delighted that, after many years of hard work, their water scheme had at length become an accomplished fact.

Water Supplies in Cornwall.—Mr. A. W. Brightmore, M.Inst.C.E., an Inspector of the Local Government Board, held two inquiries in Cornwall last week with reference to water supplies. At Redruth, the Urban District Council asked for power to spend £266, the balance of an old loan, on extending the mains to a district which is at present outside the area of supply. Ratepayers attended the inquiry in support of a memorial that the extension should go farther than the Council proposed, and stated that they had been asking for a supply of water for fifteen years and had not got it. Mr. Kistler, the Chairman of the Council, said they were anxious to extend the mains as near the country districts as possible; but they could not be expected to go down by roads to various tenements. There was no estimate of the cost of the scheme of the memorialists. The second inquiry was at Perranporth, for which the Truro Rural District Council propose to provide a water supply at a cost of £2512. Mr. H. Worth, the Engineer for the scheme, explained his plans, which include the provision of a reservoir; and evidence was given by Dr. Bonar, the Medical Officer of Health, and by the Sanitary Inspector, as to the need of the proposed supply. At present the district, which attracts a large number of visitors in the summer, is supplied from wells.

The Davis Gas Stove Co., Ltd., Luton.

Jan. 24,



1911.

Statement.

TO adopt the "STEAMLESS" is to reduce your Radiator MAINTENANCE PROBLEM to vanishing point, because the "Steamless" does not require inspecting periodically. Once fixed, it always gives its best results without any attention.

TO let the "Steamless" on hire to your Consumers is to please them and create at once a tremendous increase in gas output. On all hands you effect

A Direct Saving of

S	T	E
A	M	L
E	S	S
R	A	D
I	A	T
O	R	S

£ s. d.

Note our Show-Room Addresses:

City Offices and Show-Rooms: 59, Queen Victoria Street, E.C. (Phone: 742 Bank.)
Manchester Show-Rooms: 4, Victoria Arcade, Deansgate. (Phone: 4689 City.)
Paris Show-Rooms: 82, Rue D'Hauteville.

Water Supply in Tenement Houses.

At the Tower Bridge Police Court last Wednesday, before Mr. Cecil Chapman, William Walter Johnson, of Southwark Bridge Road, was summoned as the owner of a tenement house in Great Dover Street for having failed to provide a proper and sufficient supply of water on the upper storeys, as required by an order served on Dec. 24 last. Mr. Topham supported the information, on behalf of the Southwark Borough Council. Failure to comply with the order was admitted; but Mr. Croom-Johnson, for the defence, urged that the previous proceedings had been against "the owner" and not against the defendant by name. The premises were let to a quarterly tenant, who was responsible. Mr. Topham submitted that under the General Powers Act of 1907 proceedings must be taken against the owner and not against the tenant. His Worship said that, having regard to the character of the neighbourhood, he thought the owner must have been aware that there was sub-letting. On the point as to the owner, his view was that the position had been altered by the Act cited. He did not think there was any question as to the defendant's responsibility. On his undertaking to do the work within fourteen days, the summons might be adjourned. The necessary undertaking was given.

New Joint-Stock Companies Registered.—The Kitson Empire Lighting Company, Limited, has been registered with a capital of £20,000, in £1 shares. The Weald District Gaslight, Coke, and Coal Company, Limited, has a capital of £6000, in £1 shares; 3000 being 8 per cent. cumulative "A" preference shares, and a like number "B" ordinary shares. The Chiddingfold and District Water Company, Limited, has a capital of £15,000 in £1 shares. The Newton-Stewart Gas Company has been registered in Edinburgh—to manufacture, sell, or supply light in the town of Newton-Stewart in Wigtownshire, and in Creebridge and Miningaff in Kirkcudbrightshire. The capital is £5000 in £2 shares.

Chester Corporation and the Water Company's Bill.—A special meeting of the Chester Town Council was held last Wednesday to consider the Bill now being promoted by the Chester Water Company to obtain power to construct a storage reservoir for a large reserve supply of water for the city, &c. A resolution was read from the Ratepayers' Association urging the Council to oppose the Bill. Alderman J. Egerton Gilbert, in moving a resolution that the Council comply with this request, said there was not the slightest hostility on the part of the Council to the Water Company and their proposals; but the Council wanted to put themselves on a proper footing to carry on negotiations with the Company. They had approached Dr. Houston (the Director of Water Examination of the Metropolitan Water Board) on certain aspects of the question bacteriologically, and they would also require expert financial assistance in dealing with some points that would arise. It was therefore impossible to go into the merits of the Bill; but the ratepayers might rest assured that their interests were being fully protected. The resolution was carried without dissent.

Dispute as to a Mantle Contract.

In the High Court of Justice on Monday and Tuesday last week, Mr. Edward Pollock, Official Referee, had before him a claim made by Messrs. Killing and Co., manufacturers of gas-mantles, against Messrs. Henrich and Co., a firm of merchants, to recover the sum of £554, the balance of an account for goods supplied. The defendants counter-claimed for profits lost owing to the mantles delivered to them not being in accordance with orders and requirements. Mr. Hohler, K.C., and Mr. Jones appeared for the plaintiffs; Sir Frederick Low, K.C., and Mr. Pike Glasgow represented the defendants. On behalf of the plaintiffs, it was stated that the defendants had never specified what kind of burner the mantles were wanted for, or they would have been supplied. After the midday interval on Tuesday, Sir Frederick Low said that, in view of the evidence which had been given, it would not be to his clients' interests to contest the claim further. They would consent to judgment on the claim and counterclaim for £479, with costs. The Official Referee said he thought the defendants were very wise in acting as they had done.

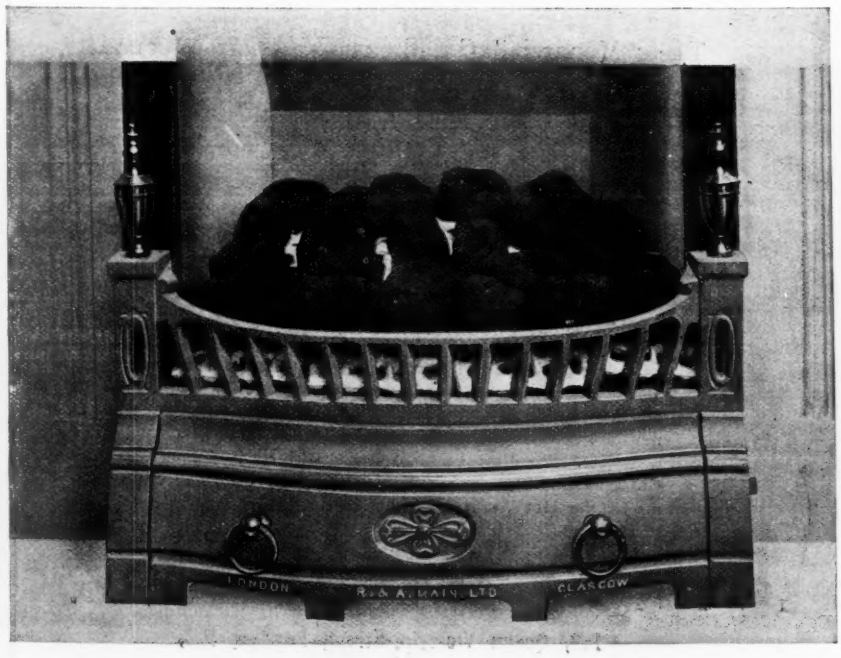
Bradford Rate Collector Sentenced.

At the Bradford Quarter Sessions, last Tuesday, the Recorder (Mr. T. R. D. Wright) passed a sentence of twelve months' hard labour on William Peel (27), who pleaded guilty to several charges of falsifying the Corporation rate-books and of issuing bogus receipts with intent to defraud. Mr. Fleming, for the prosecution, said Peel was employed up to Dec. 9 as clerk and collector in the City Treasurer's general receiving office. His system of fraud must have begun by him receiving two separate amounts, and giving only one receipt for the combined sum. He would then make out two separate counterfoils, and thereby have one blank receipt form in hand. When he used this form, he put the money into his own pocket. The embezzlement was discovered through a discrepancy of threepence in his accounts. The fraud had probably been going on for six or seven years; and amounted to about £1704. The prisoner was unmarried, and was receiving £90 a year salary. Mr. Charles Mellor, who appeared for Peel, pointed out that he had already been severely punished in the fall from his position and by the sorrow brought on his family. The offences began with a small act of dishonesty; and the prisoner plunged deeper and deeper into the mire to hide what had gone before. Something like £100,000 passed through the young man's hands last year; and in the last three or four years he had dealt with half-a-million of money.

We have received from Ernst Hildebrandt, Limited, their new catalogue of rings, nozzles, rods, and sundry accessories used by makers of mantles and gas-burners, all of which are shown in great variety. Some of our readers may remember that Mr. Hildebrandt, the founder of the Company, was the first maker of white magnesia rods and magnesia rings; and their works at Pankow (Berlin) and Deptford turn out some millions of these articles annually.

A "MAIN" MAXIM.

"Household Gods must be respected."



One of the Household Gods is the open fire.

THE "ST. NICHOLAS" INTERIOR FITTING preserves the appearance of the open fire and makes many new friends for gas.

R. & A. MAIN, LIMITED,

WORKS: Gothic Works, EDMONTON, N.; and Gothic Ironworks, FALKIRK.
SHOW-ROOMS: 25, Princes Street, Oxford Circus, W.; 136, Renfield Street, GLASGOW; 56, Broad Street, BIRMINGHAM; 83, Old Market Street, BRISTOL; 13, Whitworth Street West, MANCHESTER; and 333, Queen Street, MELBOURNE.

Suicides by Gas.—An innkeeper named Alfred Curns Williams committed suicide at Plymouth last week by poisoning himself with gas. His licence was being taken away on the ground of redundancy; and Williams, who was depressed in consequence of this, attached a piece of rubber tubing to the gas-bracket in his bedroom, and put the other end in his mouth. An inquest was held last Wednesday at Devonport on William Henry Evans, a public-house manager, who also committed suicide by gas. Evidence was given that he had been in ill-health, but had seemed in better spirits than usual on the preceding Monday. On being left in the house alone, however, he fixed up a connection with the gas-bracket, and lay down with the end in his mouth. Deceased had apparently been reading a report of the Plymouth case. A man named William Henry Adams was found dead, with the end of a gas-pipe in his mouth, in the house of his relatives at Babbacombe, Torquay, last Tuesday evening. At the inquest, a verdict of "Suicide while of unsound mind" was returned.

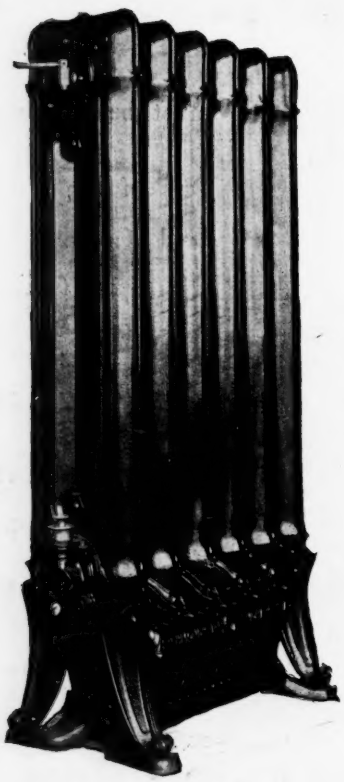
Accident and Sickness Regulations for Manchester Corporation Workmen.—By direction of the Manchester City Council, the Town Clerk (Mr. T. Hudson) has collected and had printed the regulations which govern the treatment of Corporation workmen in the event of accident or sickness. It is laid down that in all cases of accident the provisions of the Workmen's Compensation Act must be strictly adhered to. Men who have been in the employ of the Corporation continuously for six months are given half wages for a month if incapacitated from work by sickness. Should the illness last longer than a month, each case will be dealt with upon its merits. According to the rules, however, the Corporation cannot pay more than two months' sick allowance in any one year. The clerical staffs are not regarded as workmen; and the term "sickness" includes certain dental trouble, but not the effects of excesses. A sick workman may leave his home for a change of air on furnishing a medical certificate; but he is not allowed to visit licensed houses. On resumption of duties, a workman who has been on the sick list must produce a medical certificate of fitness.

Water Supply of Big Cities.—In the Osborne Street School, Hull, on Monday last week, Mr. C. B. Newton, the Corporation Water Engineer, delivered an interesting lecture on the above-named subject; the object being to compare the position of the water supply of Hull with that of other large towns. He said the water supplied to Hull was obtained by pumping from the chalk, from the great deposit in East Yorkshire extending from the Vale of Pickering on the north to the Humber on the south. It had been computed that the volume of fresh water available amounted to upwards of 40 million gallons per day. The daily supply of 11 million gallons was drawn at two pumping-stations, and distributed for consumption over an area of 25 square miles, supplying a population of nearly 300,000, besides the heavy requirements of the works and mills. Mr. Newton gave interesting descriptions of the water-works of Glasgow, Liverpool, Manchester, and Birmingham, which he had selected for comparison with those of Hull. These cities were, he said, all driven by necessity to seek new supplies of water in lakes many miles away from their borders. At the close, he exhibited a map showing how it is proposed, with the sanction of Parliament, to supply the whole of Holderness, and if necessary including its seaside resorts, with a pure water.

Gas v. Electricity at Salcombe.—A proposal for the introduction of electric light has been under the consideration of the Salcombe District Council; and, after negotiating with the originators of the scheme, the Streets Committee recommended that, on a satisfactory agreement being entered into, no opposition should be offered to the application for a Provisional Order. When the recommendation of the Committee came up for confirmation, Captain Ryder expressed the opinion that the Council should oppose. He remarked that hard things had been said about the Gas Company; but it had been a great convenience and benefit to the town in the past. Now, however, it was proposed to let a competitor come in, and give it privileges which the Gas Company had never had. His opinion was that the supplies of water and light should be in the hands of the public authorities; and it would be a good thing for the Council to purchase the gas-works. Gas was far more economical than electricity. Mr. Williams suggested that the Gas Company should make an offer of their works to the Council. The Chairman (Mr. Pike) explained that anyone could apply for a Provisional Order for the supply of electric light, and the Council could only oppose it to safeguard the interests of the ratepayers. By the proposed agreement their grounds of opposition would be removed.

The Block Light Company, Limited, of Manchester, have sent u a set of three of the very effective post-cards, of which they say they have distributed gratis something like a quarter-of-a-million, illustrating the four-light inverted gas arc lamp which was introduced into this country from America last June, and which has, they state, been most favourably received. The cards depict the special features of the lamp. It can be easily turned on or off by means of the chain pull; and a lady can remove any part or renew mantles while the lamp is hot. It is claimed for it that it will give the light of 487 candles with a consumption of 12½ cubic feet of gas, and that it is noiseless in action.

At the meeting of the Islington Borough Council on Friday, Alderman Saint moved: "That this Council urges the eleven members who have given notice of their intention to resign from the Lighting Committee to withdraw the same in order that such members may reconsider their position." The matter was referred to in the "JOURNAL" a few weeks ago. It was common knowledge, said Alderman Saint, that eleven out of the seventeen members who formed the Committee had expressed a desire to be relieved of their responsibilities as members of the Committee; the reason given being that a scheme which they had brought before the Council had been rejected. He felt sure that the Council had absolute confidence in the Lighting Committee, and had nothing but good feeling towards its members. The motion was carried unanimously, and the eleven members then agreed to withdraw their resignations.



Richmond's "Monarch."

The "Monarch" Gas-Steam Radiator is complete in itself, has Gas-Air Adjuster and Removable Burner. Its combined qualities of low maintenance and gas consumption with maximum heat make it the most efficient heater on the market.

We are receiving enquiries in large numbers daily, and our sales this season are greater than ever.

A prominent Nonconformist Minister writes:—

"I have pleasure in bearing testimony to the efficiency of your Gas-Steam Radiators which were placed in our Institute Room and Lecture Hall last winter. They heated our large rooms admirably, caused no anxiety, were no trouble, and, best of all, were odourless. We have been so pleased with their efficiency that my Church Committee are considering ways and means of having the use of the Hot Water Apparatus in the Church replaced by your Radiators."

THE RICHMOND GAS STOVE & METER CO., LTD.

132, Queen Victoria Street, London, E.C.

WORKS:—WARRINGTON.

Gas and Water Bills in Parliament.

Nearly the whole of the 128 Private Bills being promoted in the next session of Parliament have been before the Examiners of Standing Order Proofs since last Tuesday. In the majority of cases there has been no opposition at this preliminary stage; and the Bills have been allowed to proceed to the stage at which they will be considered in Committee so soon as the Private Bill Committees of both Houses are constituted.

Hints on Boilers.

In the course of the proceedings last Wednesday week of the Association of Engineers-in-Charge, Mr. Alfred E. Wheeler read a paper entitled "Engineering Plant in Institutions;" and in it he dealt at some length with the subject of steam-boilers. One of the most original of the precautions against the ill-effects of scale is, he said, a substance which —itself a good conductor of heat, and to which scale will not adhere—is painted on the inner surface of the boiler-plate. In a boiler treated with this preparation, the scale is often found to crack off by itself and fall to the bottom, and that which still adheres is easily removed. The efficiency of a boiler depends upon its ability to transfer to the water as much as possible of the heat contained in the fuel. If the whole of the heat contained in a good quality steam coal could be utilized, 5·7 horse-power-hours could be obtained from a single pound. The nearest we have to this in practice is 1·25 horse-power-hours with a suction-gas apparatus, or 22 per cent. thermal efficiency. The chief losses in a steam plant are occasioned by (*a*) the gases resulting from combustion passing to the chimney at too high a temperature, (*b*) the inleakage of cold air through faulty boiler-settings and flues, (*c*) an insufficiency of air for complete combustion, and (*d*) the waste of exhaust steam and condenser water. The first cause is often the result of the boilers being too small for the duty required of them. The temperature of the gases—for economy—leaving a steam-boiler should not exceed 400° Fahr.; and for the purpose of checking this a useful item in the boiler-room equipment is a pyrometer. A rough-and-ready means of determining the temperature is by inserting in the flue strips of metal of different melting-points. Thus, tin melts at 442° Fahr., lead at 617° Fahr., zinc at 780° Fahr., and aluminium at 1175° Fahr. By hanging strips of each of these metals in the flue, the approximate temperature may be determined. In the interests of fuel economy, it is good policy to employ boilers of ample capacity. Since the transmission of heat through boiler-plates is proportional to the difference of temperature on each side of the plate, it will follow that to increase the output of steam from a given area of surface it will be necessary to increase the temperature and the rate of combustion—or, in homely language, to force the fires. This must of necessity greatly increase the temperature of the gases passing to atmosphere, and reduce the thermal efficiency of the boiler. To utilize the heat of these waste gases, an economizer is employed in boiler plants where the flue temperature is high. Very little advantage is obtained by the use of an economizer where the flue gases pass to the chimney at less than 350°; but at higher temperatures, considerable economy results—often as much as 20 per cent. Low temperature chimney gases affect the draught of boilers. The combustion of 1 lb. of coal requires approximately from 15 to 20 lbs. of air (200 to 260 cubic feet). To supply this air is one of the functions of the chimney; and the flow in the chimney is proportional to the height and temperature. The flues of a boiler are often of great length, which involves much friction; and it will be readily seen that the air supply must suffer if the temperature falls too low. One of the direct results of shortage of air supply is that part of the fuel gases are distilled by heat and pass to the chimney as carbon monoxide, unconsumed and wasted.

The Highways Committee, of the Wandsworth Borough Council, report having considered a letter from the Wandsworth and Putney Gaslight Company, forwarding a plan showing about the position of a proposed high-pressure gas-mains in High Street, Putney, Upper Richmond Road, Putney Hill, Lower Richmond Road, and Putney Bridge Road, and asking whether the Council contemplate lighting these roads with high-pressure lamps, so that provision can be made therefor; and notices received from the Company of their intention to lay such mains. The Council are not to object to the laying of the proposed mains, subject to the whole of the work being carried out to the satisfaction of the Borough Engineer, and to the Company paying the cost of reinstating the public way in accordance with the Council's schedule of prices; and the Company are to be informed that the question of lighting the streets with high-pressure lamps will receive consideration.

APPLICATIONS FOR LETTERS PATENT.

599.—Ignot-Robin, J., "Packing mantles." Jan. 9.
685.—Pittler Universal Rotary Machine Syndicate, Ltd., "Rotary compressors." A communication from "Internationale Rotations-Maschinen Ges." Jan. 10.
688.—Binnie, W. J. E., "Automatic stop-valves for water-mains." Jan. 10.
690.—Koppers, H., "Combined gas generators and coke-ovens." Jan. 10.
704.—Glascodine, R. T., "Railway carriage gas-lighting." Jan. 10.
738.—Pasley, J. J., "Gas pendants." Jan. 11.
785.—Pfleiderer, C., "Compressing gases." Jan. 11.
844.—Ofenbau G. m. b. H., "Doors for gas-retorts." Jan. 12.
900.—Holzwarth, H., and Junghans, E., "Gas-turbines." Jan. 12.
919.—Till, E., "Gas-engines." Jan. 13.
931.—Wilson, H. W., "Petrol-gas generators." Jan. 13.
1015.—Haughton, T. J., "Globe for inverted lights." Jan. 14.
1059.—Presser, E., "Photometer." Jan. 14.
1073.—Kupferberg, B. A., "Gas-producers." Jan. 14.

Gas Plant and all constructional Steel and Iron Work.

Specialists in Slot Meters, Ordinary Meters, Wet & Dry.

WILLEY & CO., LTD., ENGINEERS,

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We have received the first number of "Fertilisers," a new monthly sixpenny publication devoted to the industry indicated by the title. It opens with an article on "The Manufacturer *v.* The Chemist," which gained the prize of ten guineas offered by the conductors; the successful competitor being Mr. F. Patton, the Manager of the Wirral Refining and Manure Company, Limited, of Birkenhead. Good features are the articles on the markets, on home and foreign fertilizer prospects, and trade figures. Under the heading "The Production of Sulphate of Ammonia," accounts are given of visits to the Beckton and South Metropolitan Gas-Works, and some particulars are furnished of what is being done in other countries. Altogether, the 30 large quarto pages contain much useful matter; and improvements are promised.

TAR PRODUCTS PRICES.

Representative manufacturers give the following as fair current values for the week ending Jan. 21. Prices are net, and they include the usual packages and delivery f.o.b., f.a.s., or f.o.r., as customary.

Article.	Basis.	London.	North-East Coast.	East Coast, Yorks.	West Coast.		Glasgow.
					Liverpool.	Manchester.	
Tar crude	per ton	22/6	19/6 22/6	19/6 23/-	18/6 22/6	20/6 22/6	—
Pitch	,,	38/- 39/-	37/- 37/6	37/6	37/6	37/- 37/6	37/6 38/-
Benzol, 90 %	per gallon	-/10½	-/9½	-/9	-/8¾	-/9	-/9¾
Benzol, 50-90%	,,	—	-/10	-/9½	-/9½	-/9½	—
Toluol, 90%	,,	—	-/9½	-/10	-/10	-/9¾	-/10
Crude naphtha, 30%	,,	—	-/3¼ -/3½	-/3½	-/3½	-/3¾	-/3¾
Light oil, 50%	,,	—	-/3¼	-/3½ -/3¾	-/3⅝	-/3¼ -/3½	—
Solvent naphtha, 90-160	,,	—	-/10½ -/11	-/10	-/10	-/11	-/11⅛
Heavy naphtha, 90-190	,,	—	-/11	-/11½	-/11¼	-/11⅜	-/11½
Creosote in bulk	,,	-/2½ -/2¾	-/2 -/2¼	-/2	-/2⅛	-/2 3/16	-/1⅞
Heavy oils	,,	-/3¼	-/2⅛ -/3	-/2¼	-/2⅛	-/2⅛	-/3
Carbolic Acid, 60's	,,	1/1½	1/- 1/1	1/1	1/1	1/1	1/1½
Naphthalene, crude drained salts	per ton	—	42/6 45/-	40/- 42/6	47/6	47/6 50/-	—
,, pressed	,,	—	60/-	63/-	60/-	60/- 72/6	—
,, whizzed	,,	—	—	—	70/- 72/6	60/- 75/-	65/-
Anthracene	per unit	-/2	-/1⅜	-/1½	-/1¼	-/1¼	—

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Situations Vacant.

GAS WORKS ENGINEER AND DRAUGHTSMAN. No. 5350.
MANAGER. Fakenham Gas Company.
REPRESENTATIVE. No. 5349.
CLERKS. Rhondda Gas and Water Department. Applications by Feb. 3.
MANAGER (Parkinson Stove Company). No. 5343.

Situations Wanted.

GAS ENGINEER AND MANAGER. No. 5348.
SHOW-ROOM ATTENDANT. No. 5346.

Meeting.

BARNSTAPLE GAS COMPANY. Bridge Hall, Barnstaple. Feb. 18. Twelve o'clock.

Stocks and Shares.

GREAT YARMOUTH WATER COMPANY. By Auction. Feb. 11.
SUNDERLAND AND SOUTH SHIELDS WATER COMPANY. By Auction. Feb. 21.

TENDERS FOR

Boiler.

HUDDERSFIELD GAS DEPARTMENT. Tenders by Feb. 4.

Fire-Clay Goods.

TODMORDEN GAS DEPARTMENT.

General Stores (Paint, Oil, Tallow, Waste, Iron and Steel, Asbestos Goods, Tools, &c.).
DEVONPORT GAS DEPARTMENT. Tenders by Feb. 11.

Glass Chimneys, &c.

CALCUTTA CORPORATION. Tenders by Feb. 28.

Lime.

SALFORD GAS DEPARTMENT. Tenders by Feb. 9.

Mantles, Protectors, &c.

CALCUTTA CORPORATION. Tenders by Feb. 28.
DEVONPORT GAS DEPARTMENT. Tenders by Feb. 11.

Pipes, &c.

DEVONPORT GAS DEPARTMENT. Tenders by Feb. 11.

Retort Setting.

TODMORDEN GAS DEPARTMENT.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

Subscribers who desire to avail themselves of the reduction in the Subscription by paying in advance for the Year 1911, are reminded that this can only be done during the present month.

Orders for Alterations in, or stoppages of, PERMANENT ADVERTISEMENTS should be received by the FIRST POST on SATURDAY.

Wanted, For Sale, and Tender Advertisements, Six Lines and under, 3s.; each additional Line, 6d.

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